

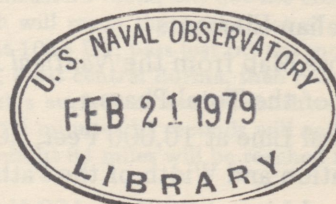
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UNITED STATES NAVAL OBSERVATORY

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U. S. Naval Observatory, Washington, D. C. 20390

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TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980

by

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and

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GENERAL INFORMATION

PATH AND VISIBILITY. At approximately 0712 UT on 16 February 1980, the center of the umbra of the Moon's shadow will touch the Earth at sunrise in the central Atlantic Ocean just on the south side of the equator, approximately midway between Ascension Island and Freetown, Sierra Leone. Traveling east and a little south, the path of the umbra will reach the west coast of Africa at the mouth of the Congo River at 0727 UT. There the path will be about 75 miles wide. Moving nearly straight east, the path will cross the continent in little more than an hour and reach the east coast at approximately 0834 UT. Along the way it will cross the northwestern tip of Angola, including Cabinda, southern Zaire, north central Tanzania, and the southern tip and coast of Kenya. It should cover the southeastern flank, but not the crest, of Kilimanjaro. After traveling northeast across the Arabian Sea, the path will reach the west coast of India at 1010 UT, emerge on the east coast of India into the Bay of Bengal at 1026 UT, pass just off the mouths of the Ganges River, enter Bangladesh at Chittagong at nearly 1030 UT, cross central Burma, then pass into the Peoples' Republic of China before 1033 UT, and leave the Earth's surface at sunset southwest of Chungking at approximately 1034 UT. Maximum duration in excess of 4 minutes 12 seconds will occur at the equator just off the east coast of Africa; maximum path width of about 94 miles will be reached there also.

Partial phases of the eclipse, of magnitude decreasing with the distance from the path of total phase, will be visible over all of Africa except the north central coast, the Middle Eastern area excluding Turkey, the Indian subcontinent, central USSR, China, Southeast Asia, northern Philippines, and the western half of Indonesia. The sun will rise in partial eclipse for the portions of northern Africa west of a curve from Accra to Ouagadougou to Marrakech. The sun will set in partial eclipse for southern Siberia, Mongolia, Peoples' Republic of China, Thailand, Cambodia, Laos, Viet Nam, Taiwan, Philippines, and Borneo. On the central path, the sun will set in eclipse for points east of central Burma, near Shwebo. The central line ends where the sun sets at maximum eclipse.

PARAMETERS AND CORRECTIONS. The predictions in this *Circular* are derived from the basic data in the *American Ephemeris and Nautical Almanac for the Year 1980*. The arguments here are in Universal Time, using $\Delta T = 50^s.73$ to interpolate the solar ephemeris. To refer the $j=2$ lunar ephemeris to the FK4 equinox, a correction $-1^s.34$ was applied to ΔT for the interpolation of the Moon's coordinates. In a change from past calculations, no correction was applied to the tabular latitude of the Moon to correct for center of mass. The ratio of the Moon's radius to the Earth's equatorial radius is taken to be $k=0.2724880$, except for calculations of duration on the central line at various altitudes, where the value $k=0.272281$ has been used by way of applying an approximate correction for the irregularities of the lunar limb.

LOCAL CIRCUMSTANCES. Following are some notes on and explanations of tabular quantities.

Time arguments are Universal Time.

Longitudes east of Greenwich are negative, west are positive.

First and fourth contacts are, respectively, the beginning and end of the partial phase. Second and third contacts are, respectively, the beginning and end of the total phase, if any. Duration is the time interval between second and third contacts. Dot leaders indicate that a phenomenon occurs below the horizon for that position.

The *position angle* of a point of contact on the solar limb is measured eastward (counterclockwise) around the solar limb. P is the position angle measured from the north point of the limb, V is the position angle measured from the vertex point. The north point lies on the great circle arc drawn from the north celestial pole to the center of the solar disk; the vertex lies on the great circle arc drawn from the zenith to the center of the solar disk.

The *azimuth* of the Sun is measured along the horizon from the north point through the east point.

The *magnitude* of the eclipse is by definition the fraction of the apparent diameter of the solar disk covered by the Moon at the time of greatest phase, expressed in units of the solar diameter. For partial phase at maximum eclipse, the magnitude is less than 1. For total phase at maximum eclipse, the magnitude is the diameter of the Moon's disk in units of the solar diameter. Degree of *obscuration*, prepared especially for this *Circular*, is the fraction (per cent) of the area of the apparent solar disk obscured by the Moon at maximum eclipse. For a few points near the edge of the path of totality, rounding and neglect of altitude may indicate total obscuration for points predicted to be outside the path.

Inexperienced observers are cautioned that at anything less than total obscuration, even 99%, the Sun should not be observed directly without safe filters.

The Path of the Total Phase, Local Circumstances for Points on the Central Line, and the path plotted on the detail maps are all calculated for mean sea level. When the terrain has an elevation of several hundred feet, the times of phenomena may be changed a second or two, and the predicted limits of the path may be shifted by tenths of a minute of arc.

Local circumstances for selected cities in Africa, India, and Asia are tabulated by country. For places in or near the path of total phase, coordinates and altitudes are from the detail maps. For other cities, coordinates are from the *Times Atlas of the World 1967*. For observatories, coordinates and altitudes are from the records of the Nautical Almanac Office.

Approximate local circumstances for places not listed may be obtained as follows:

A. Over a large area around a listed location, times of contact vary by only a few seconds. If the position is in the path of totality, consult the appropriate detail map, times listed for nearby towns, and the table of Local Circumstances for Points on the Central Line.

B. Use the overall eclipse map taken from the *Nautical Almanac*. Note: although the label says GMT is used, it should be treated as Ephemeris Time. The curves drawn in long dashes indicate the times midway between first and last contacts of the penumbra; these times of the middle of the eclipse should not be confused with the times of maximum eclipse, from which they may differ by several minutes. The curves drawn in short dashes give the semi-duration of the partial phase. The times of the first and last contacts to the nearest minute are derived from the time of the middle of the eclipse by respectively subtracting and adding the semi-duration, then subtracting 1 minute by way of approximate correction to Universal Time. For observers within the distorted ovals at the extreme east and west of the limit curves of the eclipse, part of the eclipse occurs below the horizon.

Example: Estimate times of first and last contacts for Chittagong, Bangladesh. The point lies between the mid-eclipse curves for 1020 ET and 1030 ET, and on the semi-duration curve for 65 minutes. The estimated time of the middle of eclipse is 1026 ET. Subtracting 1 minute gives 1025 UT. Subtracting 65 minutes from 1025 UT gives 0920 UT for first contact. Adding 65 minutes to 1025 UT gives 1130 UT for last contact. By comparison, the tabulated times are 0921 UT and 1131 UT, with maximum at 1030 UT and middle at 1026 UT.

For the user's convenience, the Besselian Elements for Universal Time arguments and without the latitude correction for the Moon are presented. Precepts for their use may be found in the Explanation of any recent *American Ephemeris*.

MAPS OF THE PATH OF TOTALITY. The path of total phase over land was plotted by Nautical Almanac Office staff members. It is presented on portions of Operational Navigation Charts (ONC) M-3, M-4, M-5, K-8, J-8, J-9, J-10, H-10, H-11, scale 1:1,000,000, Lambert Conformal Conic projection. These maps are a product of Defense Mapping Agency Aerospace Center. The map portions in this *Circular* are reduced to 60% of original size, enlarging the scale from 15.78 mi/inch to 26.3 mi/inch.

The heavy solid lines mark the northern and southern limits of the predicted path of the umbra and the central line. The dashed lines represent projections of the umbral diameter, joining the northern and southern limit points and central point for the indicated instant. All points on a dashed line observe maximum eclipse at that instant.

OBSERVATIONS. It is requested that precise observations of contact times and precise coordinates of the place of observation be reported to

Nautical Almanac Office
U. S. Naval Observatory
Washington, D. C. 20390

FURTHER INFORMATION. Inquiries concerning local circumstances and the path may be directed to this office.

Dr. M. K. V. Bappu, Chairman, Indian National Committee for Astronomy, has announced that for coordinating and guiding the various scientific teams that will observe the eclipse in India, a sub-committee has been formed. The convener, and also National Coordinator for India, is

Prof. J. C. Bhattacharyya
Indian Institute of Astrophysics
Bangalore, 560034, India

Prospective observers may wish to contact him directly concerning weather information, local accommodations, customs, etc.

Similarly, the coordinator for the Republic of Kenya is

S. J. M. Njoroge
Ministry of Power and Communications
Kenya Meteorological Department
P. O. Box 30259
Nairobi, Kenya

CLIMATOLOGICAL INFORMATION

AFRICA: Dr. R. G. Giovanelli has been in contact with local meteorological offices both in Africa and in India. From Africa, he has received information from the Director General of the Meteorological Department Headquarters, Nairobi, Kenya, concerning weather prospects for Kenya. At the representative sites of Malindi, Lamu, and Voi, all in the central path, statistics for the general period 1962-1974 were provided. With respect to cloud cover, it appears that at 0900 GMT, there is a greater than 60% chance of more than 50% clouds. At 1200 GMT the same is true at Voi. On the other hand, at Malindi and Lamu there is a greater than 60% chance of less than 50% clouds at 1200 GMT. The temperature at Voi ranges from 20.3°C to 33.1°C; at Malindi and Lamu it ranges from 23°C to 31°C. All stations average humidity exceeding 75% at 0600 GMT, declining at 1200 GMT to 66% at Malindi and Lamu, and to 41% at Voi. All report average wind speeds less than 14 knots, and dust storms are not considered a potential hazard. Further information and statistics should be requested from the national coordinator for Kenya.

INDIA: Climatological information has been received from several sources. A report has been prepared by the Indian National Committee for Astronomy based upon data provided by the Director General of Observatories, New Delhi, India. The following is extracted from that report, omitting the extensive tabular statistics and maps. The data used were all collected before 1960.

The month of February, in this part of the country, is characterized by pleasant temperatures and the possibility of much clear skies. The eclipse will begin first on the west coast near Karwar in the afternoon. In extreme eastern India mid-totality will occur with the sun barely above the horizon. (See Local Circumstances of Points on the Central Line, pp. 14-15.) Almost the entire track lies in populated areas with good communication facilities. Throughout the region February appears to be warm with a little clouding and a small amount of rainfall. The instances of this region being affected by storms or other synoptic scale disturbances are very rare.

Temperature. The mean maximum temperature is about 29°C for coastal stations and it increases to about 34°C for plains areas in the interior. The mean minimum temperatures range from 21°C to 19°C for plain and coastal stations and lower by 2-4°C for elevated stations. Mean daily temperature exceeds 26°C over plains, but for coastal and elevated stations it is below 25°C. The mean diurnal range of temperature is about 9°C to 12°C for coastal stations and 13°C to 15°C for most of the other areas.

Cloudiness. The month of February is one of the least clouded months of the year in the entire region as compared to the other months. Evenings are comparatively more cloudy. Mean cloud covers in the evening range between 2 octas (2/8ths of sky) to 3 octas, except at a few isolated places on 40-50% of occasions.

Evenings with all cloud cover of 2 octas or less range from 55% to about 78% and with cover of 6-8 octas about 4% to 20%. On the whole, the portion of the path falling between longitudes 80°E to about 82°E is less clouded in comparison to other areas.

Rainfall. Total rainfall during February is less than 1 cm west of 80°E and it increases gradually to a maximum of about 2.5 cm in the east. Similarly the mean monthly number of days with rainfall equal to or greater than 2.5 mm are less than one west of about 81°E and 1 to 2 per month to the east. The coefficient of variation of the monthly rainfall is 100% for the entire region.

Relative Humidity. In the afternoons, relative humidity ranges from 70% along the coast to about 25% to 30% in the interior. In the mornings the relative humidity is higher, ranging from 70% to 80% along the coast and gradually decreasing in the interior to a minimum of about 40%.

Surface winds. Winds are mostly calm or light in the mornings. Mostly light to moderate winds (6 to 28 kmph) blow in the afternoons. On a few occasions moderate to strong winds (20 to 48 kmph) are also encountered. The prevailing wind direction for land breeze is easterly for the west coastal stations. In the afternoons the land breeze is replaced by a sea breeze from the opposite direction. In the interior prevailing winds are generally easterly both in mornings and evenings.

Special weather phenomena. Occurrence of hail is extremely rare and that of dust storms is very rare. Over small areas of western ghats (mountains) fog occurs on 4 to 9 days per month. Occasional (less than one day per month) fog occurs along the east coast and at a few isolated interior stations. But the occurrence, being in the mornings, is of little significance for observations of the eclipse, which is in the afternoon.

Further inquiries from observers seriously planning expeditions should be directed to the national coordinator for India.

ELEMENTS OF THE ECLIPSE

U.T. of geocentric conjunction in right ascension, February 16^d08^h59^m02^s.373
 Julian Day No. 2444285.874333021

	h	m	s		s	
Right Ascension of Sun	21	56	14.827	Hourly motion	9.729	
Right Ascension of Moon	21	56	14.827	Hourly motion	149.296	
ΔT for solar ephemeris			+50.73			
ΔT for lunar ephemeris			+49.39			
	°	'	"		'	"
Declination of Sun	−12	33	56.81	Hourly motion	+ 0	51.70
Declination of Moon	−12	19	59.43	Hourly motion	+ 9	32.09
Equatorial hor. par. of Sun			8.90	True semidiameter of Sun	16	11.4
Equatorial hor. par. of Moon	60	58.51		True semidiameter of Moon	16	36.9

CIRCUMSTANCES OF THE ECLIPSE

	U. T.	Longitude	Latitude
	d h m	° '	° '
Eclipse begins	February 16 06 15.1	+ 1 32.4	- 5 50.2
Central eclipse begins	16 07 12.0	+ 14 46.0	- 1 23.0
Central eclipse at local apparent noon	16 08 59.0	- 48 46.9	+ 0 42.2
Central eclipse ends	16 10 34.3	-108 34.8	+26 35.1
Eclipse ends	16 11 31.1	- 95 33.4	+22 09.5

TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980

BESSELIAN ELEMENTS

Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane	
x	y	sin d	cos d	μ	Penumbra	Umbra
-1.576765	-0.171508	-0.218242	0.975895	268.95312	0.539399	-0.006913
1.485386	0.147826	.218202	.975904	271.45345	.539400	.006912
1.392004	0.124139	.218162	.975912	273.95377	.539401	.006911
1.298619	0.100447	.218123	.975921	276.45409	.539401	.006911
1.205231	0.076750	.218083	.975930	278.95441	.539400	.006912
-1.111840	-0.053048	-0.218043	0.975939	281.45473	0.539398	-0.006913
1.018446	0.029341	.218003	.975948	283.95506	.539396	.006915
0.925050	-0.005630	.217964	.975957	286.45538	.539393	.006918
0.831651	+0.018087	.217924	.975966	288.95570	.539390	.006922
0.738251	0.041809	.217884	.975975	291.45603	.539385	.006926
0.644849	0.065535	.217845	.975983	293.95635	.539380	.006931
-0.551446	+0.089265	-0.217805	0.975992	296.45668	0.539375	-0.006937
0.458044	0.113000	.217765	.976001	298.95700	.539368	.006943
0.364640	0.136739	.217725	.976010	301.45733	.539361	.006950
0.271237	0.160483	.217685	.976019	303.95765	.539353	.006958
0.177834	0.184230	.217646	.976028	306.45797	.539344	.006967
-0.084432	0.207982	.217606	.976037	308.95830	.539335	.006976
+0.008971	+0.231738	-0.217566	0.976046	311.45862	0.539325	-0.006986
0.102373	0.255498	.217526	.976054	313.95895	.539314	.006997
0.195774	0.279262	.217487	.976063	316.45927	.539303	.007008
0.289174	0.303029	.217447	.976072	318.95960	.539290	.007021
0.382573	0.326801	.217407	.976081	321.45992	.539277	.007033
0.475970	0.350577	.217367	.976090	323.96025	.539264	.007047
+0.569366	+0.374356	-0.217328	0.976099	326.46057	0.539249	-0.007061
0.662759	0.398139	.217288	.976108	328.96090	.539234	.007076
0.756149	0.421925	.217248	.976116	331.46123	.539219	.007092
0.849537	0.445715	.217208	.976125	333.96155	.539202	.007108
0.942921	0.469509	.217168	.976134	336.46188	.539185	.007126
1.036302	0.493306	.217129	.976143	338.96220	.539167	.007143
+1.129680	+0.517107	-0.217089	0.976152	341.46253	0.539148	-0.007162
1.223053	0.540911	.217049	.976161	343.96286	.539129	.007181
1.316422	0.564719	.217009	.976170	346.46318	.539109	.007201
1.409787	0.588529	.216969	.976178	348.96351	.539088	.007222
1.503147	0.612343	.216930	.976187	351.46384	.539066	.007243
1.596502	0.636160	.216890	.976196	353.96416	.539044	.007266
+1.689852	+0.659980	-0.216850	0.976205	356.46449	0.539021	-0.007288
1.783198	0.683803	.216810	.976214	358.96482	.538998	.007312
1.876538	0.707629	.216770	.976223	1.46514	.538973	.007336
1.969872	0.731457	.216730	.976232	3.96547	.538948	.007361
2.063201	0.755288	.216691	.976240	6.46580	.538922	.007387
+2.156523	+0.779121	- .216651	.976249	8.96613	.538896	- .007413

$$\tan f_1 = 0.004733$$

$$\tan f_2 = 0.004709$$

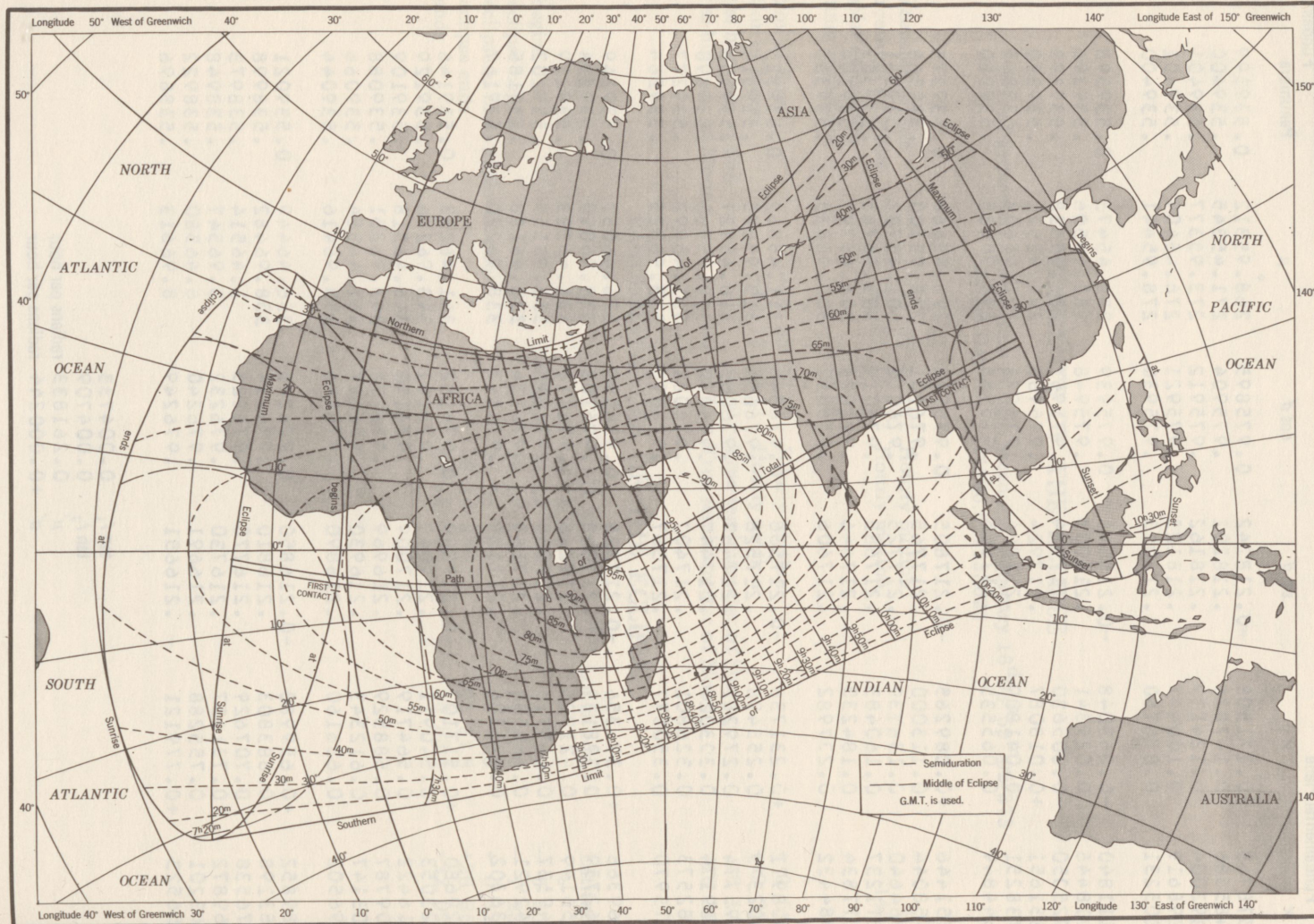
$$\mu'$$

$$d'$$

$$0.261833 \text{ radians per hour}$$

$$+0.000244 \text{ radians per hour}$$

TOTAL SOLAR ECLIPSE OF 1980 FEBRUARY 16



PATH OF THE TOTAL PHASE

Universal Time	Northern Limit		Central Line		Southern Limit	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
	^h ^m	[°] [']	[°] [']	[°] [']	[°] [']	[°] [']
	Limit	- 0 59	+ 14 42	- 1 23	+ 14 46	- 1 47	+ 14 50
7 12	.. ..	.. ..	.. ..	.. ..	- 2 16.9	+ 12 37.0
13	- 2 26.7	+ 7 42.3	- 2 57.9	+ 7 20.3	3 28.6	7 01.6
14	3 01.8	4 37.0	3 32.4	4 21.6	4 02.8	4 08.3
7 15	- 3 26.1	+ 2 20.0	- 3 56.8	+ 2 07.3	- 4 27.3	+ 1 56.3
20	4 33.9	- 5 09.9	5 05.9	- 5 18.7	5 37.8	- 5 26.5
25	5 06.8	10 11.8	5 40.0	10 20.0	6 13.1	10 27.3
7 30	- 5 23.9	- 14 10.2	- 5 58.1	- 14 18.5	- 6 32.3	- 14 26.1
35	5 31.1	17 31.3	6 06.2	17 39.9	6 41.2	17 47.9
40	5 31.3	20 27.0	6 07.1	20 36.2	6 42.9	20 44.8
45	5 26.1	23 04.4	6 02.5	23 14.1	6 38.8	23 23.4
50	5 16.5	25 27.7	5 53.3	25 38.0	6 30.2	25 48.0
55	5 03.2	27 39.8	5 40.4	27 50.8	6 17.6	28 01.4
8 00	- 4 46.7	- 29 42.9	- 5 24.1	- 29 54.5	- 6 01.7	- 30 05.9
05	4 27.2	31 38.5	5 05.0	31 50.8	5 42.7	32 02.8
10	4 05.2	33 28.0	4 43.1	33 40.9	5 21.0	33 53.6
15	3 40.9	35 12.3	4 18.8	35 25.8	4 56.9	35 39.1
20	3 14.3	36 52.3	3 52.3	37 06.4	4 30.4	37 20.3
25	2 45.6	38 28.6	3 23.7	38 43.2	4 01.7	38 57.7
8 30	- 2 15.0	- 40 02.0	- 2 53.0	- 40 17.0	- 3 31.0	- 40 32.0
35	1 42.4	41 32.8	2 20.3	41 48.3	2 58.3	42 03.8
40	1 08.0	43 01.7	1 45.8	43 17.6	2 23.6	43 23.5
45	- 0 31.8	44 29.0	1 09.5	44 45.3	1 47.1	45 01.6
50	+ 0 06.2	45 55.2	- 0 31.3	46 11.9	1 08.8	46 28.6
55	0 45.9	47 20.8	+ 0 08.6	47 37.8	- 0 28.7	47 54.7
9 00	+ 1 27.5	- 48 46.2	+ 0 50.4	- 49 03.3	+ 0 13.3	- 49 20.6
05	2 10.8	50 11.7	1 33.9	50 29.0	0 57.1	50 46.5
10	2 56.0	51 37.8	2 19.4	51 55.3	1 42.8	52 12.9
15	3 43.1	53 05.1	3 06.7	53 22.6	2 30.4	53 40.3
20	4 32.1	54 33.9	3 56.0	54 51.4	3 20.0	55 09.2
25	5 23.1	56 04.9	4 47.3	56 22.4	4 11.7	56 40.1
9 30	+ 6 16.4	- 57 38.6	+ 5 40.9	- 57 56.0	+ 5 05.5	- 58 13.7
35	7 11.9	59 15.9	6 36.7	59 33.1	6 01.7	59 50.6
40	8 10.0	60 57.5	7 35.1	61 14.5	7 00.4	61 31.7
45	9 10.7	62 44.5	8 36.2	63 01.2	8 01.8	63 18.1
50	10 14.5	64 38.2	9 40.3	64 54.4	9 06.3	65 11.0
55	11 21.8	66 40.3	10 47.9	66 55.9	10 14.2	67 12.0
10 00	+12 32.9	- 68 52.8	+11 59.4	- 69 07.8	+11 26.2	- 69 23.2
05	13 48.8	71 18.8	13 15.7	71 32.9	12 42.8	71 47.5
10	15 10.3	74 02.6	14 37.6	74 15.6	14 05.2	74 29.2
15	16 39.2	77 10.8	16 07.0	77 22.5	15 35.0	77 34.7
20	18 18.1	80 55.2	17 46.4	81 04.9	17 15.0	81 15.3
10 22	+19 01.6	- 82 39.5	+18 30.1	- 82 48.2	+17 58.9	- 82 57.7
24	19 48.1	84 35.4	19 16.8	84 42.9	18 45.8	84 51.3
26	20 38.4	86 46.8	20 07.3	86 52.8	19 36.6	86 59.7
28	21 34.0	89 20.1	21 03.1	89 23.9	20 32.6	89 29.0
30	22 37.8	92 27.3	22 07.0	92 28.1	21 36.6	92 30.3
10 32	+23 56.5	- 96 39.4	+23 25.5	- 96 34.2	+22 54.9	- 96 31.0
33	24 48.4	99 40.4	24 16.5	99 28.2	23 45.4	99 19.1
34	+26 13.0	-105 07.9	+25 34.6	-104 20.5	+24 59.2	-103 47.8
Limit	+26 59	-108 30	+26 35	-108 35	+26 11	-108 40

Universal Time	10, 000 Feet		20, 000 Feet		30, 000 Feet		40, 000 Feet	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
	^h ° ' "	^m ° ' "	^h ° ' "	^m ° ' "	^h ° ' "	^m ° ' "	^h ° ' "	^m ° ' "
7 12	- 1 44.5	+ 13 10.2	- 1 54.7	+ 12 24.8	- 2 02.3	+ 11 50.8	- 2 08.6	+ 11 22.4
13	3 00.4	7 08.8	3 02.9	6 57.5	3 05.3	6 46.5	3 07.6	6 35.8
14	3 34.2	4 13.5	3 35.9	4 05.4	3 37.6	3 57.5	3 39.3	3 49.6
7 15	- 3 58.2	+ 2 10.7	- 3 59.6	+ 1 54.1	- 4 01.0	+ 1 47.6	- 4 02.3	+ 1 41.2
20	5 06.7	- 5 22.6	5 07.5	- 5 26.5	5 08.3	- 5 30.4	5 09.1	- 5 34.3
25	5 40.6	10 22.9	5 41.2	10 25.9	5 41.8	10 28.8	5 42.3	10 31.1
7 30	- 5 58.6	- 14 20.9	- 5 59.0	- 14 23.3	- 5 59.5	- 14 25.8	- 6 00.0	- 14 28.2
35	6 06.6	17 42.0	6 07.0	17 44.0	6 07.4	17 46.1	6 07.8	17 48.1
40	6 07.4	20 38.0	6 07.8	20 39.8	6 08.2	20 41.5	6 08.5	20 43.3
45	6 02.8	23 15.7	6 03.1	23 17.3	6 03.5	23 18.8	6 03.8	23 20.4
50	5 53.6	25 39.4	5 53.9	25 40.8	5 54.3	25 42.2	5 54.6	25 43.5
55	5 40.7	27 52.0	5 41.0	27 53.2	5 41.3	27 54.4	5 41.6	27 55.6
8 00	- 5 24.4	- 29 55.6	- 5 24.7	- 29 56.7	- 5 25.0	- 29 57.8	- 5 25.3	- 29 58.8
05	5 05.2	31 51.8	5 05.5	31 52.7	5 05.8	31 53.7	5 06.1	31 54.6
10	4 43.4	33 41.8	4 43.7	33 42.6	4 43.9	33 43.4	4 44.2	33 44.3
15	4 19.1	35 26.6	4 19.4	35 27.3	4 19.7	35 28.0	4 19.9	35 28.8
20	3 52.6	37 07.0	3 52.9	37 07.6	3 53.2	37 08.3	3 53.4	37 08.9
25	3 23.9	38 43.8	3 24.2	38 44.3	3 24.5	38 44.9	3 24.8	38 45.4
8 30	- 2 53.3	- 40 17.5	- 2 53.6	- 40 18.0	- 2 53.9	- 40 18.4	- 2 54.2	- 40 18.9
35	2 20.6	41 48.7	2 21.0	41 49.1	2 21.3	41 49.5	2 21.6	41 49.8
40	1 46.2	43 17.9	1 46.5	43 18.2	1 46.8	43 18.5	1 47.1	43 18.8
45	1 09.8	44 45.5	1 10.2	44 45.7	1 10.5	44 46.0	1 10.8	44 46.2
50	- 0 31.7	46 12.0	- 0 32.0	46 12.2	- 0 32.4	46 12.3	- 0 32.8	46 12.4
55	+ 0 08.2	47 37.8	+ 0 07.9	47 37.9	+ 0 07.5	47 37.9	+ 0 07.1	47 38.0
9 00	+ 0 50.0	- 49 03.3	+ 0 49.6	- 49 03.3	+ 0 49.2	- 49 03.3	+ 0 48.8	- 49 03.3
05	1 33.5	50 28.9	1 33.1	50 28.8	1 32.7	50 28.8	1 32.3	50 28.7
10	2 18.9	51 55.1	2 18.5	51 55.0	2 18.0	51 54.8	2 17.6	51 54.6
15	3 06.2	53 22.4	3 05.8	53 22.1	3 05.3	53 21.9	3 04.8	53 21.6
20	3 55.5	54 51.1	3 55.0	54 50.8	3 54.5	54 50.4	3 54.0	54 50.1
25	4 46.8	56 22.0	4 46.3	56 21.5	4 45.8	56 21.1	4 45.2	56 20.7
9 30	+ 5 40.3	- 57 55.5	+ 5 39.7	- 57 55.0	+ 5 39.2	- 57 54.5	+ 5 38.6	- 57 54.0
35	6 36.1	59 32.5	6 35.5	59 31.9	6 34.9	59 31.3	6 34.3	59 30.6
40	7 34.4	61 13.8	7 33.8	61 13.0	7 33.2	61 12.3	7 32.5	61 11.6
45	8 35.5	63 00.3	8 34.8	62 59.5	8 34.1	62 58.7	8 33.5	62 57.8
50	9 39.6	64 53.5	9 38.9	64 52.5	9 38.1	64 51.5	9 37.4	64 50.6
55	10 47.1	66 54.8	10 46.3	66 53.7	10 45.5	66 52.6	10 44.7	66 51.4
10 00	+11							

DURATION OF TOTAL PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time	10,000 Feet			20,000 Feet			30,000 Feet			40,000 Feet		
	Duration		Width of Path	Duration		Width of Path	Duration		Width of Path	Duration		Width of Path
	h	m	m s mi	m	s	mi	m	s	mi	m	s	mi
7 12			1 27.8	56	1 29.2	57	1 30.2	57	1 31.1	57		
13			1 39.5	60	1 39.9	61	1 40.3	61	1 40.6	61		
14			1 45.8	63	1 46.1	63	1 46.4	63	1 46.7	63		
7 15			1 50.9	64	1 51.1	64	1 51.4	64	1 51.6	64		
20			2 09.8	70	2 09.9	70	2 10.1	70	2 10.3	70		
25			2 24.4	74	2 24.5	74	2 24.7	74	2 24.8	74		
7 30			2 37.0	77	2 37.1	77	2 37.3	77	2 37.4	77		
35			2 48.3	80	2 48.5	80	2 48.6	80	2 48.8	80		
40			2 58.7	82	2 58.8	83	2 59.0	83	2 59.1	83		
45			3 08.2	84	3 08.3	84	3 08.5	84	3 08.6	84		
50			3 17.0	86	3 17.1	86	3 17.2	86	3 17.4	86		
55			3 25.0	87	3 25.1	87	3 25.3	87	3 25.4	87		
8 00			3 32.3	89	3 32.5	89	3 32.6	89	3 32.7	89		
05			3 39.0	90	3 39.1	90	3 39.3	90	3 39.4	90		
10			3 45.0	91	3 45.1	91	3 45.3	91	3 45.4	91		
15			3 50.3	92	3 50.5	92	3 50.6	92	3 50.7	92		
20			3 54.9	93	3 55.1	93	3 55.2	93	3 55.3	93		
25			3 58.9	94	3 59.0	93	3 59.2	93	3 59.3	93		
8 30			4 02.1	94	4 02.3	94	4 02.4	94	4 02.5	94		
35			4 04.7	94	4 04.8	94	4 05.0	94	4 05.1	94		
40			4 06.5	94	4 06.7	94	4 06.8	94	4 07.0	95		
45			4 07.7	94	4 07.8	94	4 08.0	94	4 08.1	95		
50			4 08.2	94	4 08.3	94	4 08.5	94	4 08.6	95		
55			4 08.0	94	4 08.1	94	4 08.3	94	4 08.4	94		
9 00			4 07.2	94	4 07.3	94	4 07.4	94	4 07.6	94		
05			4 05.7	94	4 05.8	94	4 05.9	94	4 06.1	94		
10			4 03.5	93	4 03.6	93	4 03.7	93	4 03.9	93		
15			4 00.7	93	4 00.8	93	4 01.0	93	4 01.1	92		
20			3 57.3	92	3 57.4	92	3 57.5	92	3 57.7	92		
25			3 53.2	91	3 53.4	91	3 53.5	91	3 53.7	91		
9 30			3 48.7	90	3 48.8	90	3 48.9	90	3 49.1	91		
35			3 43.5	90	3 43.6	90	3 43.7	90	3 43.8	90		
40			3 37.7	89	3 37.8	89	3 37.9	89	3 38.1	89		
45			3 31.3	87	3 31.5	87	3 31.6	87	3 31.7	87		
50			3 24.4	86	3 24.5	86	3 24.7	87	3 24.8	87		
55			3 16.9	85	3 17.0	85	3 17.1	85	3 17.3	85		
10 00			3 08.7	83	3 08.9	83	3 09.0	83	3 09.1	83		
05			2 59.9	82	3 00.1	82	3 00.2	82	3 00.3	82		
10			2 50.4	80	2 50.5	80	2 50.6	80	2 50.8	80		
15			2 39.9	78	2 40.1	78	2 40.2	78	2 40.3	78		
20			2 28.3	75	2 28.5	75	2 28.6	75	2 28.8	75		
10 22			2 23.2	74	2 23.4	74	2 23.5	74	2 23.7	74		
24			2 17.8	72	2 18.0	72	2 18.2	72	2 18.3	72		
26			2 12.0	71	2 12.2	71	2 12.4	71	2 12.5	71		
28			2 05.6	69	2 05.8	69	2 06.0	69	2 06.2	69		
30			1 58.3	67	1 58.6	67	1 58.8	67	1 59.0	68		
10 32			1 49.5	64	1 49.7	64	1 50.0	64	1 50.3	64		
33			1 43.8	63	1 44.1	63	1 44.4	63	1 44.8	63		
34			1 35.2	59	1 35.8	60	1 36.4	60	1 37.0	60		

CENTRAL LINE OF TOTAL PHASE

Universal Time	80 Km		100 Km		200 Km		300 Km	
	Latitude		Latitude		Latitude		Latitude	
	°	'	°	'	°	'	°	'
7 08	..	..	..	..	..	..	- 3	30.6 + 6 22.8
09	..	..	..	..	- 2	42.1 + 9 46.0	4	04.6 3 28.2
10	..	..	..	..	3	33.2 5 35.6	4	28.7 + 1 17.2
11	- 2	28.7 + 10 10.8	- 2	53.0 + 8 20.9	4	03.1 2 58.6	4	47.6 - 0 31.5
12	3	20.2 5 58.0	3	33.6 4 56.1	4	25.2 + 0 55.4	5	03.1 2 05.9
7 14	- 4	12.4 + 1 15.1	- 4	20.9 + 0 35.1	- 4	57.5 - 2 20.1	- 5	27.6 - 4 46.9
16	4	44.9 - 2 02.4	4	51.4 - 2 33.9	5	20.9 4 57.5	5	46.2 7 03.2
18	5	08.2 4 41.5	5	13.6 5 08.1	5	38.6 7 11.8	6	00.7 9 02.9
7 20	- 5	25.9 - 6 57.3	- 5	30.6 - 7 20.6	- 5	52.5 - 9 10.3	- 6	12.2 - 10 50.3
25	5	55.0 11 35.6	5	58.6 11 53.7	6	15.6 13 20.7	6	31.2 14 41.7
7 30	- 6	10.3 - 15 20.6	- 6	13.3 - 15 35.7	- 6	27.4 - 16 48.2	- 6	40.5 - 17 56.7
35	6	16.6 18 32.7	6	19.2 18 45.6	6	31.4 19 47.8	6	42.9 20 47.0
40	6	16.4 21 22.0	6	18.6 21 33.1	6	29.5 22 27.4	6	39.8 23 19.3
45	6	10.9 23 54.3	6	13.0 24 04.1	6	23.0 24 51.9	6	32.5 25 37.7
50	6	01.2 26 13.5	6	03.1 26 22.1	6	12.5 27 04.4	6	21.4 27 45.1
55	5	47.9 28 22.2	5	49.7 28 29.9	5	58.6 29 07.4	6	07.2 29 43.6
8 00	- 5	31.4 - 30 22.3	- 5	33.2 - 30 29.2	- 5	41.8 - 31 02.5	- 5	50.1 - 31 34.7
05	5	12.1 32 15.4	5	13.8 32 21.5	5	22.4 32 51.1	5	30.6 33 19.6
10	4	50.2 34 02.6	4	51.9 34 08.0	5	00.5 34 34.1	5	08.7 34 59.3
15	4	26.0 35 44.9	4	27.7 35 49.5	4	36.3 36 12.4	4	44.6 36 34.6
20	3	59.6 37 22.9	4	01.4 37 26.9	4	10.1 37 46.8	4	18.6 38 06.1
25	3	31.1 38 57.4	3	32.9 39 00.9	3	41.9 39 17.9	3	50.6 39 34.5
8 30	- 3	00.7 - 40 28.9	- 3	02.6 - 40 31.9	- 3	11.8 - 40 46.2	- 3	20.8 - 41 00.1
35	2	28.3 41 58.1	2	30.3 42 00.5	2	39.9 42 12.2	2	49.3 42 23.6
40	1	54.2 43 25.3	1	56.2 43 27.1	2	06.3 43 36.4	2	16.0 43 45.3
45	1	18.2 44 50.9	1	20.4 44 52.3	1	30.9 44 59.1	1	41.2 45 05.6
50	0	40.5 46 15.5	0	42.8 46 16.4	0	53.9 46 20.7	1	04.6 46 24.9
55	- 0	01.1 47 39.4	- 0	03.4 47 39.8	- 0	15.1 47 41.7	- 0	26.4 47 43.6
9 00	+ 0	40.2 - 49 02.9	+ 0	37.6 - 49 02.8	+ 0	25.3 - 49 02.4	+ 0	13.4 - 49 01.9
05	1	23.1 50 26.6	1	20.5 50 26.1	1	07.5 50 23.2	0	54.8 50 20.4
10	2	07.9 51 50.9	2	05.1 51 49.8	1	51.3 51 44.4	1	38.0 51 39.3
15	2	54.6 53 16.1	2	51.6 53 14.5	2	37.0 53 06.6	2	22.8 52 59.0
20	3	43.1 54 42.8	3	40.0 54 40.6	3	24.4 54 30.2	3	09.4 54 20.0
25	4	33.7 56 11.4	4	30.3 56 08.7	4	13.8 55 55.5	3	57.9 55 42.8
9 30	+ 5	26.3 - 57 42.7	+ 5	22.8 - 57 39.4	+ 5	05.2 - 57 23.4	+ 4	48.3 - 57 07.8
35	6	21.2 59 17.2	6	17.4 59 13.3	5	58.8 58 54.2	5	40.8 58 35.7
40	7	18.6 60 55.8	7	14.5 60 51.2	6	54.6 60 28.8	6	35.4 60 07.2
45	8	18.5 62 39.4	8	14.2 62 34.1	7	53.0 62 08.1	7	32.5 61 43.0
50	9	21.4 64 29.3	9	16.7 64 23.1	8	54.0 63 53.1	8	32.1 63 24.2
55	10	27.5 66 26.9	10	22.5 66 19.8	9	58.2 65 45.2	9	34.7 65 12.0
10 00	+11	37.5 - 68 34.2	+11	32.1 - 68 26.0	+11	05.8 - 67 46.1	+10	40.5 - 67 08.0
05	12	51.8 70 53.8	12	45.9 70 44.3	12	17.5 69 58.2	11	50.1 69 14.2
10	14	11.5 73 29.7	14	05.1 73 18.5	13	34.0 72 24.6	13	04.3 71 33.5
15	15	38.0 76 27.5	15	30.9 76 14.2	14	56.7 75 10.3	14	24.0 74 10.1
20	17	13.6 79 56.9	17	05.7 79 40.6	16	27.2 78 22.8	15	50.8 77 10.5
25	19	02.8 84 16.4	18	53.5 83 55.3	18	09.0 82 16.0	17	27.4 80 45.6
10 30	+21	16.3 - 90 11.4	+21	04.4 - 89 40.4	+20	09.2 - 87 19.8	+19	19.1 - 85 17.7
32	22	23.3 93 29.8	22	09.4 92 50.2	21	06.1 89 57.1	20	10.5 87 33.1
34	+23	49.7 - 98 10.5	+23	30.9 - 97 10.4	22	12.4 93 13.2	21	08.1 90 14.0
36	..	..	..	..	23	37.7 97 50.8	22	15.9 93 37.5
10 37	..	..	..	..	+24	40.5 -101 37.2	+22	56.5 - 95 47.9
38	..	..	..	..	..	..	23	46.1 98 37.2
39	..	..	..	..	..	..	+25	02.0 -103 21.8

DURATION OF TOTAL PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time	80 Km			100 Km			200 Km			300 Km		
	Duration		Width of Path mi	Duration		Width of Path mi	Duration		Width of Path mi	Duration		Width of Path mi
	h	m		m	s		m	s		m	s	
7 08	.	..	..	.	..	..	.	..	..	1	39.5	61
09	.	..	..	.	..	..	1	33.0	58	1	46.0	63
10	.	..	..	.	..	..	1	41.8	61	1	51.3	65
11	1	33.0	59	1	36.5	60	1	47.7	63	1	55.9	66
12	1	41.6	61	1	43.8	62	1	52.7	65	1	60.0	67
7 14	1	52.4	65	1	53.9	65	2	01.0	67	2	07.5	69
16	2	00.6	67	2	02.0	68	2	08.2	69	2	14.2	71
18	2	07.8	70	2	08.9	70	2	14.7	71	2	20.3	73
7 20	2	14.1	71	2	15.3	72	2	20.8	73	2	26.1	74
25	2	28.3	75	2	29.3	75	2	34.3	76	2	39.3	77
7 30	2	40.7	78	2	41.7	78	2	46.5	79	2	51.3	81
35	2	51.9	80	2	52.9	81	2	57.6	82	3	02.3	83
40	3	02.2	83	3	03.1	83	3	07.7	84	3	12.4	85
45	3	11.7	85	3	12.6	85	3	17.2	86	3	21.9	86
50	3	20.4	87	3	21.3	87	3	25.9	87	3	30.6	88
55	3	28.5	88	3	29.4	89	3	34.0	89	3	38.6	90
8 00	3	35.8	89	3	36.7	89	3	41.3	90	3	46.0	91
05	3	42.5	91	3	43.4	91	3	48.0	92	3	52.7	92
10	3	48.5	91	3	49.4	92	3	54.0	92	3	58.8	93
15	3	53.8	92	3	54.7	93	3	59.4	93	4	04.1	94
20	3	58.4	93	3	59.3	93	4	04.0	94	4	08.7	95
25	4	02.4	94	4	03.3	93	4	07.9	94	4	12.7	95
8 30	4	05.6	94	4	06.5	94	4	11.2	95	4	15.9	95
35	4	08.2	95	4	09.1	94	4	13.7	95	4	18.5	95
40	4	10.0	95	4	10.9	95	4	15.6	95	4	20.3	95
45	4	11.2	95	4	12.1	95	4	16.7	95	4	21.4	95
50	4	11.7	95	4	12.6	95	4	17.2	95	4	21.9	95
55	4	11.5	95	4	12.4	94	4	17.0	95	4	21.6	95
9 00	4	10.6	94	4	11.5	94	4	16.0	95	4	20.7	95
05	4	09.1	94	4	10.0	94	4	14.5	95	4	19.1	95
10	4	06.9	93	4	07.8	93	4	12.3	94	4	16.8	95
15	4	04.1	93	4	04.9	93	4	09.4	93	4	14.0	94
20	4	00.6	92	4	01.5	93	4	05.9	93	4	10.4	94
25	3	56.6	91	3	57.4	92	4	01.8	92	4	06.3	93
9 30	3	52.0	91	3	52.8	91	3	57.2	92	4	01.6	92
35	3	46.7	90	3	47.6	90	3	51.9	91	3	56.3	91
40	3	40.9	89	3	41.8	89	3	46.1	90	3	50.4	90
45	3	34.6	88	3	35.4	89	3	39.7	89	3	44.0	90
50	3	27.6	87	3	28.5	87	3	32.7	87	3	37.1	89
55	3	20.1	86	3	21.0	86	3	25.2	87	3	29.5	87
10 00	3	12.0	84	3	12.8	85	3	17.1	85	3	21.4	85
05	3	03.2	83	3	04.1	83	3	08.4	83	3	12.7	85
10	2	53.7	81	2	54.6	81	2	59.0	82	3	03.4	82
15	2	43.4	79	2	44.3	79	2	48.8	79	2	53.3	81
20	2	32.0	76	2	32.9	76	2	37.6	78	2	42.3	78
25	2	19.0	73	2	20.1	73	2	25.2	74	2	30.1	76
10 30	2	03.4	68	2	04.7	69	2	10.6	70	2	16.3	72
32	1	55.6	67	1	57.1	67	2	03.8	69	2	10.0	71
34	1	45.7	63	1	47.6	64	1	56.0	66	2	02.9	69
36	.	..	..	.	..	..	1	45.9	63	1	54.7	66
10 37	.	..	..	.	..	..	1	38.5	60	1	49.8	65
38	.	..	..	.	..	..	.	..	..	1	43.9	62
39	.	..	..	.	..	..	.	..	..	1	34.8	60

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

Universal Time	Central Line		First Contact			Second Contact		
	Latitude	Longitude	Universal Time	P	V	Universal Time	P	V
	° ' "	° ' "	h m s	°	°	h m s	°	°
7 13	- 2 57.9	+ 7 20.3	.. .. .	...	...	7 12 09.1	81	172
14	3 32.4	4 21.6	.. .. .	...	...	7 13 05.8	80	172
7 15	- 3 56.8	+ 2 07.3	.. .. .	...	...	7 14 03.2	80	171
20	5 05.9	- 5 18.7	6 16 06.2	260	354	7 18 53.6	79	170
25	5 40.0	10 20.0	6 17 53.2	259	352	7 23 46.3	78	168
7 30	- 5 58.1	- 14 18.5	6 20 04.7	259	351	7 28 39.8	77	166
35	6 06.2	17 39.9	6 22 31.5	258	350	7 33 34.1	76	164
40	6 07.1	20 36.2	6 25 09.4	257	348	7 38 28.9	75	162
45	6 02.5	23 14.1	6 27 56.2	257	347	7 43 24.1	75	160
50	5 53.3	25 38.0	6 30 50.6	256	345	7 48 19.6	74	158
55	5 40.4	27 50.8	6 33 51.8	255	344	7 53 15.5	73	156
8 00	- 5 24.1	- 29 54.5	6 36 59.7	255	342	7 58 11.9	72	153
05	5 05.0	31 50.8	6 40 13.9	254	340	8 03 08.5	71	150
10	4 43.1	33 40.9	6 43 34.3	253	338	8 08 05.5	71	147
15	4 18.8	35 25.8	6 47 01.3	253	336	8 13 02.8	70	143
20	3 52.3	37 06.4	6 50 34.6	252	334	8 18 00.4	69	139
25	3 23.7	38 43.2	6 54 14.8	251	332	8 22 58.4	68	134
8 30	- 2 53.0	- 40 17.0	6 58 01.9	251	329	8 27 56.8	68	128
35	2 20.3	41 48.3	7 01 56.4	250	327	8 32 55.5	67	121
40	1 45.8	43 17.6	7 05 58.6	249	324	8 37 54.6	66	112
45	1 09.5	44 45.3	7 10 08.6	249	321	8 42 54.0	66	101
50	- 0 31.3	46 11.9	7 14 27.2	248	317	8 47 53.8	65	90
55	+ 0 08.6	47 37.8	7 18 54.5	247	313	8 52 53.8	65	77
9 00	+ 0 50.4	- 49 03.3	7 23 30.9	247	309	8 57 54.3	64	64
05	1 33.9	50 29.0	7 28 16.9	246	303	9 02 55.1	64	53
10	2 19.4	51 55.3	7 33 12.7	246	298	9 07 56.2	64	44
15	3 06.7	53 22.6	7 38 18.7	245	291	9 12 57.5	63	36
20	3 56.0	54 51.4	7 43 35.4	245	283	9 17 59.3	63	29
25	4 47.3	56 22.4	7 49 03.1	244	275	9 23 01.3	63	24
9 30	+ 5 40.9	- 57 56.0	7 54 42.1	244	265	9 28 03.7	63	20
35	6 36.7	59 33.1	8 00 32.6	244	255	9 33 06.2	63	17
40	7 35.1	61 14.5	8 06 35.2	244	245	9 38 09.2	63	14
45	8 36.2	63 01.2	8 12 49.9	243	236	9 43 12.4	63	12
50	9 40.3	64 54.4	8 19 17.4	243	227	9 48 15.9	63	10
55	10 47.9	66 55.9	8 25 58.0	243	220	9 53 19.7	63	8
10 00	+11 59.4	- 69 07.8	8 32 52.3	243	213	9 58 23.8	64	7
05	13 15.7	71 32.9	8 40 01.2	243	208	10 03 28.3	64	6
10	14 37.6	74 15.6	8 47 26.3	244	204	10 08 33.1	64	6
15	16 07.0	77 22.5	8 55 09.7	244	200	10 13 38.4	65	5
20	17 46.4	81 04.9	9 03 16.1	245	197	10 18 44.3	66	5
10 22	+18 30.1	- 82 48.2	9 06 38.9	245	195	10 20 46.9	66	5
24	19 16.8	84 42.9	9 10 07.8	245	194	10 22 49.6	66	5
26	20 07.3	86 52.8	9 13 44.3	246	193	10 24 52.5	67	5
28	21 03.1	89 23.9	9 17 31.0	246	193	10 26 55.7	67	5
30	22 07.0	92 28.1	9 21 33.3	247	192	10 28 59.5	68	5
10 32	+23 25.5	- 96 34.2	9 26 03.7	247	191	10 31 04.0	68	6
33	24 16.5	99 28.2	9 28 41.6	248	191	10 32 06.9	69	6
34	+25 34.6	-104 20.5	9 32 11.9	249	191	10 33 11.4	70	7

TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980

15

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

Maximum Eclipse				Third Contact			Fourth Contact			Duration		Width of Path
Universal Time	Magnitude	Sun's Alt.	Sun's Az.	Universal Time	P	V	Universal Time	P	V	m	s	
h m s		°	°	h m s	°	°	h m s	°	°			mi
7 13 00.0	1.028	8	102	7 13 50.9	261	352	8 17 39.5	80	168	1	41.8	60
7 14 00.0	1.029	11	102	7 14 54.2	260	352	8 20 34.1	79	167	1	48.4	63
7 15 00.0	1.030	14	102	7 15 56.8	260	351	8 23 05.2	79	166	1	53.6	64
7 20 00.0	1.033	22	102	7 21 06.4	259	349	8 33 37.9	78	164	2	12.8	70
7 25 00.0	1.035	29	101	7 26 13.7	258	348	8 42 46.7	76	161	2	27.4	74
7 30 00.0	1.036	34	101	7 31 20.2	257	346	8 51 13.1	75	158	2	40.4	77
7 35 00.0	1.037	38	101	7 36 25.9	256	344	8 59 09.7	74	155	2	51.8	80
7 40 00.0	1.038	42	101	7 41 31.1	255	342	9 06 42.0	73	151	3	02.2	82
7 45 00.0	1.039	46	102	7 46 35.9	255	340	9 13 53.2	72	147	3	11.8	84
7 50 00.0	1.040	50	103	7 51 40.4	254	338	9 20 45.4	71	142	3	20.8	86
7 55 00.0	1.041	53	103	7 56 44.5	253	335	9 27 19.9	70	134	3	29.0	87
8 00 00.0	1.041	56	105	8 01 48.1	252	333	9 33 37.9	69	125	3	36.2	89
8 05 00.0	1.042	59	106	8 06 51.5	251	330	9 39 40.7	68	111	3	43.0	90
8 10 00.0	1.042	62	108	8 11 54.5	251	326	9 45 29.1	68	91	3	49.0	91
8 15 00.0	1.043	65	110	8 16 57.2	250	322	9 51 04.0	67	69	3	54.4	92
8 20 00.0	1.043	67	114	8 21 59.6	249	318	9 56 26.7	66	49	3	59.2	93
8 25 00.0	1.043	69	118	8 27 01.6	248	313	10 01 37.7	66	34	4	03.2	94
8 30 00.0	1.044	72	123	8 32 03.2	248	316	10 06 37.8	65	24	4	06.4	94
8 35 00.0	1.044	74	129	8 37 04.5	247	298	10 11 28.0	65	17	4	09.0	94
8 40 00.0	1.044	75	137	8 42 05.4	246	289	10 16 08.9	64	12	4	10.8	94
8 45 00.0	1.044	76	147	8 47 06.0	246	278	10 20 41.1	64	8	4	12.0	94
8 50 00.0	1.044	77	158	8 52 06.2	245	265	10 25 05.4	64	5	4	12.4	94
8 55 00.0	1.044	77	170	8 57 06.2	245	252	10 29 22.3	63	3	4	12.4	94
9 00 00.0	1.044	77	182	9 02 05.7	244	240	10 33 32.2	63	1	4	11.4	94
9 05 00.0	1.044	76	193	9 07 04.9	244	229	10 37 35.6	63	359	4	09.8	94
9 10 00.0	1.044	74	201	9 12 03.8	244	220	10 41 32.9	63	358	4	07.6	93
9 15 00.0	1.044	72	208	9 17 02.5	243	213	10 45 24.6	63	357	4	05.0	93
9 20 00.0	1.044	70	214	9 22 00.7	243	207	10 49 10.8	63	357	4	01.4	92
9 25 00.0	1.043	68	219	9 26 58.7	243	202	10 52 51.9	63	356	3	57.4	91
9 30 00.0	1.043	65	223	9 31 56.3	243	198	10 56 28.0	63	356	3	52.6	90
9 35 00.0	1.043	63	226	9 36 53.8	243	195	10 59 59.2	63	356	3	47.6	90
9 40 00.0	1.042	60	228	9 41 50.8	243	193	11 03 25.6	63	356	3	41.6	89
9 45 00.0	1.042	57	231	9 46 47.6	243	191	11 06 47.2	64	356	3	35.2	87
9 50 00.0	1.041	54	233	9 51 44.1	243	189	11 10 03.8	64	356	3	28.2	86
9 55 00.0	1.041	50	235	9 56 40.3	243	188	11 13 15.2	64	356	3	20.6	85
10 00 00.0	1.040	47	236	10 01 36.2	244	187	11 16 20.9	64	356	3	12.4	83
10 05 00.0	1.039	43	238	10 06 31.7	244	186	11 19 20.0	65	357	3	03.4	82
10 10 00.0	1.038	39	240	10 11 26.9	244	185	11 22 11.7	65	357	2	53.8	80
10 15 00.0	1.037	35	241	10 16 21.6	245	185	11 24 53.6	66	358	2	43.2	78
10 20 00.0	1.036	30	243	10 21 15.7	246	185	11 27 22.6	67	359	2	31.4	75
10 22 00.0	1.035	28	244	10 23 13.1	246	185	11 28 17.0	67	359	2	26.2	74
10 24 00.0	1.035	25	245	10 25 10.4	246	185	11 29 07.5	67	0	2	20.8	72
10 26 00.0	1.034	23	246	10 27 07.5	247	185	11 29 52.9	68	1	2	15.0	71
10 28 00.0	1.033	20	247	10 29 04.3	247	185	11 30 31.0	68	1	2	08.6	69
10 30 00.0	1.032	16	249	10 31 00.5	248	185	11 30 58.2	69	2	2	01.0	67
10 32 00.0	1.030	12	251	10 32 56.0	248	186	.. .. .	...	...	1	52.0	64
10 33 00.0	1.030	9	252	10 33 53.1	249	186	.. .. .	...	...	1	46.2	63
10 34 00.0	1.028	4	254	10 34 48.6	250	187	.. .. .	...	...	1	37.2	59

LOCAL CIRCUMSTANCES

Geographic Locations	First Contact						Second Contact									
	Latitude		Longitude		Universal Time			Universal Time			P			V		
	°	'	°	'	h	m	s	°	'	h	m	s	°	'	°	'
ANGOLA																
Cabinda	- 5	33.0	- 12	10.8	6	18	52.0	259	351	7	26	10.7	48	137		
Maquela do Zombo	- 6	03.0	- 15	06.4	6	20	35.1	259	351	7	29	44.3	81	170		
Quimbele	- 6	32.1	- 16	13.5	6	21	18.1	259	352	7	31	48.3	133	222		
CONGO																
Brazzaville	- 4	18.0	- 15	15.0	6	21	12.0	255	346							
Dolisie	- 4	12.0	- 12	40.5	6	19	31.4	256	347							
Lwira, Radio Astronomy Observing Station	- 2	16.0	- 28	49.0	6	37	17.7	249	333							
Pointe-Noire	- 4	47.9	- 11	50.2	6	18	51.4	257	349							
EGYPT																
Helwan, Helwan Observatory	+29	51.5	- 31	20.5	8	09	23.0	183	217							
Kottamia, Outstation, Helwan Observatory	+29	55.9	- 31	49.5	8	10	19.6	184	216							
GHANA																
Achimota, U. of Ghana Radio Observatory	+ 5	38.0	+ 0	13.7	6	21	07.6	243	327							
KENYA																
Kilifi	- 3	37.0	- 39	41.2	6	56	08.6	252	332	8	26	07.3	116	180		
Lamu	- 2	16.0	- 40	54.0	6	59	56.6	250	327	8	30	45.4	34	90		
Malindi	- 3	14.0	- 40	06.0	6	57	20.5	251	331	8	27	12.2	91	153		
Mombasa	- 4	03.0	- 39	40.0	6	55	47.0	253	334							
Nairobi	- 1	17.0	- 36	48.0	6	52	08.4	247	326							
Voi	- 3	24.0	- 38	34.0	6	53	54.5	251	332	8	22	32.3	65	131		
SOUTH AFRICA																
Bloemfontein, Boyden Station, Mazelspoort	-29	02.3	- 26	24.3	6	56	02.3	303	60							
Cape of Good Hope, So. Afr. Astron. Obsy.	-33	56.0	- 18	28.6	7	05	46.7	320	82							
Hartbeespoort, Republic Obsy. Annexe	-25	46.4	- 27	52.6	6	49	39.8	295	48							
Johannesburg, Outstation of S.A.A.O.	-26	10.9	- 28	04.5	6	50	50.1	296	49							
Sutherland, So. African Astron. Obsy.	-32	22.8	- 20	48.6	7	01	06.8	314	74							
TANZANIA																
Arusha	- 3	22.0	- 36	40.1	6	50	03.4	251	333	8	18	26.1	5	74		
Dar es Salaam	- 6	50.0	- 39	16.0	6	53	24.8	257	343							
Kigoma	- 4	52.8	- 29	37.2	6	36	47.9	254	341	7	58	47.5	12	92		
Moshi	- 3	20.5	- 37	20.5	6	51	25.6	251	332	8	19	41.6	27	95		
Nzega	- 4	13.2	- 33	11.1	6	42	58.9	252	337	8	08	17.8	7	83		
Shinyanga	- 3	40.2	- 33	32.2	6	43	58.1	251	335							
Singida	- 4	49.0	- 34	45.0	6	45	25.1	253	338	8	11	00.7	99	175		
Tabora	- 5	02.0	- 32	50.0	6	41	53.8	254	340	8	05	40.6	83	160		
ZAIRE																
Mbanza-Ngungu	- 5	15.0	- 14	52.2	6	20	36.8	257	349							
Boma	- 5	51.0	- 13	03.3	6	19	18.8	259	351	7	27	01.9	74	163		
Kabalo	- 6	03.5	- 26	55.0	6	32	26.2	256	345	7	51	08.1	100	184		
Kabinda	- 6	08.0	- 24	29.0	6	29	20.1	257	347	7	45	51.8	89	174		
Kalemi	- 5	55.5	- 29	10.5	6	35	39.2	256	344	7	56	30.9	112	195		
Kananga (Luluabourg)	- 5	53.5	- 22	24.0	6	27	03.2	257	347	7	41	56.5	57	143		
Kikwit	- 5	02.3	- 18	49.0	6	23	48.9	256	346							
Kinshasa	- 4	20.0	- 15	18.0	6	21	13.4	255	346							
Kongolo	- 5	23.0	- 27	00.0	6	32	48.8	255	343	7	51	54.4	36	119		
Lubefu	- 4	42.7	- 24	26.2	6	29	50.5	254	342							
Lusambo	- 4	58.0	- 23	26.5	6	28	33.5	255	344							
Matadi	- 5	49.1	- 13	28.2	6	19	34.3	259	351	7	27	36.1	67	156		
Mbuji-Mayi (Bakwanga)	- 6	08.0	- 23	35.0	6	28	17.3	257	347	7	44	02.7	85	170		
Popokabaka	- 5	42.1	- 16	34.8	6	21	45.0	258	349	7	32	21.7	36	124		
Santo Antonio do Zaire	- 6	07.4	- 12	16.7	6	18	49.2	260	353	7	26	09.3	110	199		
Tshikapa	- 6	25.8	- 20	47.2	6	25	14.9	258	349	7	38	53.2	107	194		

LOCAL CIRCUMSTANCES

Obscuration	Maximum Eclipse					Third Contact					Fourth Contact					Duration		Width of Path	
	Universal Time			Sun's		Universal Time			P	V	Universal Time			P	V				
	%	h	m	s	Magnitude	Alt.		h	m	s	P	V	h	m	s	P	V		
						o	o											o	o	m	s	mi
100.0	7	27	17.2	1.035	31	101	7	28	23.6	288	17	8	46	42.1	76	160	2	12.9	75
100.0	7	31	05.6	1.036	35	101	7	32	26.9	253	342	8	53	00.3	75	157	2	42.6	78
100.0	7	32	35.1	1.037	36	101	7	33	21.9	201	290	8	55	21.5	74	156	1	33.6	78
96.2	7	31	57.5	0.963	35	102						8	54	16.3	78	157			
96.3	7	28	22.3	0.964	31	102						8	48	23.5	79	160			
90.5	7	59	45.1	0.916	54	108						9	33	13.3	75	124			
98.8	7	27	05.2	0.985	30	102						8	46	18.6	78	160			
2.5	8	42	53.6	0.074	43	151						9	16	59.4	138	154			
2.5	8	44	16.1	0.076	43	152						9	18	46.7	137	152			
63.6	7	19	49.6	0.705	14	105						8	26	42.7	96	172			
100.0	8	27	29.0	1.044	71	119	8	28	50.8	200	263	10	04	01.3	65	26	2	43.5	94
100.0	8	32	28.3	1.044	72	126	8	34	11.3	281	336	10	09	06.6	66	22	3	25.9	94
100.0	8	29	04.9	1.044	71	121	8	30	57.5	224	284	10	05	39.9	65	24	3	45.3	94
99.5	8	26	57.2	0.992	71	118						10	03	22.7	64	24			
93.4	8	21	49.6	0.939	66	119						9	58	29.9	71	56			
100.0	8	24	33.4	1.043	69	117	8	26	34.6	252	316	10	01	11.4	66	36	4	02.3	93
15.6	7	46	27.6	0.261	49	75						8	40	19.7	25	152			
4.4	7	37	53.2	0.110	39	78						8	11	19.6	12	138			
25.2	7	48	31.4	0.364	51	77						8	52	14.2	32	157			
23.8	7	48	50.3	0.350	52	77						8	51	29.2	31	157			
7.6	7	39	51.4	0.160	42	77						8	20	39.1	17	143			
100.0	8	19	17.5	1.043	66	114	8	20	08.9	314	22	9	55	48.3	68	55	1	42.8	93
89.7	8	22	55.9	0.910	71	109						9	58	10.3	60	17			
100.0	7	59	41.0	1.041	56	105	8	00	34.5	312	32	9	33	19.0	70	125	1	47.0	89
100.0	8	21	11.3	1.043	67	115	8	22	41.0	290	358	9	57	46.7	67	48	2	59.4	93
100.0	8	09	07.9	1.042	61	109	8	09	58.0	315	30	9	44	35.3	69	96	1	40.2	91
99.0	8	10	32.6	0.987	62	110						9	46	14.2	70	91			
100.0	8	12	42.1	1.043	64	109	8	14	23.4	221	296	9	48	28.9	67	79	3	22.7	91
100.0	8	07	31.4	1.042	61	107	8	09	22.3	239	317	9	42	37.7	68	102	3	41.7	90
99.6	7	31	01.9	0.994	34	102						8	52	53.6	76	158			
100.0	7	28	19.8	1.036	32	101	7	29	37.7	262	350	8	48	27.7	76	159	2	35.8	76
100.0	7	52	40.0	1.040	52	103	7	54	11.8	227	310	9	24	15.8	70	138	3	03.7	87
100.0	7	47	26.8	1.040	48	102	7	49	01.7	239	324	9	17	16.7	71	144	3	09.9	85
100.0	7	57	52.7	1.041	55	103	7	59	14.6	212	295	9	30	55.9	69	130	2	43.7	88
100.0	7	43	26.4	1.039	45	102	7	44	56.3	273	358	9	11	42.2	73	148	2	59.8	83
98.7	7	37	20.5	0.984	40	102						9	02	44.8	76	153			
96.3	7	32	01.2	0.964	35	102						8	54	22.6	78	157			
100.0	7	53	16.7	1.040	52	103	7	54	38.9	290	13	9	25	08.8	71	137	2	44.5	87
98.2	7	48	09.8	0.979	48	104						9	18	19.6	74	143			
98.8	7	45	58.9	0.985	46	103						9	15	18.7	74	146			
100.0	7	28	53.6	1.036	33	101	7	30	11.1	268	356	8	49	23.9	76	159	2	35.0	77
100.0	7	45	37.8	1.039	47	102	7	47	12.9	244	330	9	14	46.0	72	146	3	10.2	84
100.0	7	33	25.9	1.037	37	101	7	34	30.0	297	24	8	56	43.7	75	156	2	08.3	79
100.0	7	27	14.5	1.035	31	101	7	28	19.7	226	315	8	46	37.6	75	159	2	10.4	75
100.0	7	40	11.0	1.038	43	101	7	41	28.9	224	311	9	06	56.7	72	151	2	35.7	82

LOCAL CIRCUMSTANCES

Geographic Locations	Latitude		Longitude		First Contact			Second Contact		
					Universal Time			Universal Time		
	°	'	°	'	h	m	s	P	°	'
BANGLADESH										
Chittagong	+22	21.0	- 91	49.0	9	20	50.3	246	192	
Dacca	+23	43.0	- 90	25.0	9	19	32.6	242	191	
BURMA										
Mandalay	+21	58.0	- 96	05.0	9	25	30.3	249	192	
Shwebo	+22	34.0	- 95	42.0	9	25	08.6	248	192	
INDIA										
Adoni	+15	37.5	- 77	16.4	8	54	36.2	245	200	10 13 40.4 110 49
Anantapur	+14	41.0	- 77	37.0	8	54	38.5	247	200	
Angule	+20	50.0	- 85	06.0	9	11	25.4	243	193	
Balsore	+21	30.0	- 86	56.0	9	14	20.1	243	193	
Belgaum	+15	51.0	- 74	32.0	8	49	07.1	242	202	
Bellary	+15	09.0	- 76	51.0	8	53	23.0	245	201	
Berhampore	+24	08.0	- 88	16.0	9	17	07.0	240	191	
Berhampur	+19	18.5	- 84	48.0	9	10	16.5	245	194	10 22 54.7 67 5
Bhubaneswar	+20	15.0	- 85	50.0	9	12	15.2	245	194	10 24 47.1 356 295
Bidar	+17	55.0	- 77	52.0	8	57	29.1	242	198	
Bijapur	+16	49.0	- 75	43.0	8	52	24.1	242	200	
Bobbili	+18	34.5	- 83	21.5	9	07	36.8	245	195	10 21 24.1 82 20
Bombay, Govt. Observatory	+18	53.6	- 72	48.9	8	48	38.2	236	201	
Burdwan	+23	14.0	- 87	51.0	9	16	14.3	241	191	
Calcutta	+22	39.0	- 88	27.0	9	16	47.2	243	192	
Chitradurga	+14	14.0	- 76	26.0	8	51	50.0	246	202	
Contai	+21	47.0	- 87	45.0	9	15	33.4	244	192	
Cuddapah	+14	29.0	- 78	50.0	8	57	00.8	248	200	
Cuttack	+20	48.0	- 85	56.0	9	12	37.7	244	193	
Davangere	+14	27.6	- 75	55.0	8	50	53.8	245	202	
Dehra Dun, Haig Observatory	+30	18.9	- 78	02.9	9	09	03.2	222	187	
Delhi	+28	29.0	- 77	15.0	9	06	08.5	225	189	
Dharwar	+15	27.5	- 75	01.0	8	49	47.6	243	202	10 10 33.7 19 320
Eluru	+16	42.5	- 81	06.2	9	02	42.2	246	197	
Gadag	+15	25.0	- 75	38.0	8	51	03.4	244	202	10 10 59.6 54 354
Gadwal	+16	14.3	- 77	47.7	8	56	05.5	244	199	10 14 15.0 72 12
Gulberga	+17	21.0	- 76	51.0	8	55	05.3	242	199	
Guntur	+16	18.0	- 80	26.4	9	01	14.5	246	198	
Hassan	+13	00.0	- 76	09.0	8	50	19.8	248	203	
Honavar	+14	17.0	- 74	27.0	8	47	33.4	244	204	10 08 59.8 107 47
Hospet	+15	16.2	- 76	22.8	8	52	30.1	245	201	10 12 11.1 101 41
Hubli	+15	21.0	- 75	08.5	8	49	57.9	243	202	10 10 24.1 37 339
Hyderabad, Nizamiah Observatory	+17	25.9	- 78	27.2	8	58	13.8	243	198	
Ichchapuram	+19	06.5	- 84	41.2	9	10	00.6	246	195	10 22 48.4 82 21
Jagdalpur	+19	05.0	- 82	02.0	9	05	40.9	243	195	
Jaggayyapeta	+16	53.5	- 80	06.0	9	00	57.2	245	198	10 17 44.7 114 53
Kakinada	+16	57.0	- 82	14.0	9	04	52.5	247	197	
Kalingapatnam	+18	20.0	- 84	08.0	9	08	46.6	246	195	
Kurnool	+15	50.0	- 78	04.0	8	56	20.8	245	199	10 15 23.5 140 79
Karwar	+14	49.2	- 74	08.0	8	47	19.9	243	204	10 08 35.8 41 343

LOCAL CIRCUMSTANCES

Obscuration	Maximum Eclipse			Sun's Alt.	Sun's Az.	Third Contact			P	V	Fourth Contact			Duration	Width of Path			
	Universal Time	Magnitude	Universal Time			P	V	Universal Time			P	V						
													%			h	m	s
100.0	10	29	37.7	1.032	17	248	10	30	07.9	308	246	11	30	52.8	69	3	1 00.5	67
93.9	10	28	47.0	0.945	18	247						11	30	27.8	72	8		
97.5	10	31	49.8	0.974	13	251						..	..	..	..	..		
99.9	10	31	39.3	0.997	13	250						..	..	..	..	..		
100.0	10	14	38.5	1.037	35	242	10	15	36.6	200	139	11	24	40.7	65	357	1 56.2	78
97.4	10	14	35.9	0.972	35	242						11	24	30.8	63	354		
97.5	10	24	38.5	0.974	24	245						11	29	20.0	70	4		
97.6	10	26	14.0	0.975	22	246						11	29	54.1	70	4		
99.0	10	11	05.3	0.987	38	239						11	22	50.3	67	1		
99.9	10	13	51.2	0.997	36	242						11	24	14.0	65	356		
89.5	10	27	20.9	0.910	20	246						11	29	50.8	74	10		
100.0	10	24	35.0	1.034	25	245	10	25	15.3	246	184	11	29	09.5	67	0	2 20.6	72
100.0	10	25	10.0	1.034	24	245	10	25	32.8	317	256	11	29	34.5	68	2	0 45.7	71
97.2	10	16	23.6	0.971	33	241						11	25	37.1	69	3		
97.6	10	13	11.3	0.975	36	240						11	23	57.7	68	2		
100.0	10	22	33.8	1.035	27	245	10	23	43.6	230	169	11	28	31.4	67	359	2 19.5	74
84.9	10	10	06.0	0.873	38	236						11	21	45.3	74	11		
92.4	10	27	02.6	0.933	20	246						11	29	56.6	73	8		
95.4	10	27	27.1	0.957	20	246						11	30	12.3	71	6		
97.8	10	12	48.5	0.976	37	242						11	23	34.6	63	354		
97.7	10	26	53.0	0.976	21	246						11	30	06.8	70	4		
94.6	10	16	00.7	0.950	34	243						11	25	06.5	62	352		
98.8	10	25	20.3	0.985	23	245						11	29	37.0	69	3		
99.3	10	12	14.2	0.990	38	241						11	23	20.0	64	355		
52.5	10	18	02.2	0.612	26	235						11	20	11.3	91	37		
57.6	10	17	23.0	0.655	28	235						11	21	15.5	88	32		
100.0	10	11	33.1	1.038	38	240	10	12	32.6	290	231	11	23	04.9	66	359	1 58.9	79
98.8	10	19	38.2	0.985	31	244						11	27	07.1	65	356		
100.0	10	12	22.6	1.038	37	240	10	13	45.5	256	196	11	23	30.8	66	358	2 45.9	79
100.0	10	15	35.4	1.037	34	242	10	16	55.8	238	178	11	25	11.9	66	358	2 40.8	78
97.6	10	14	53.9	0.974	35	240						11	24	51.5	68	2		
98.4	10	18	44.5	0.982	31	244						11	26	40.4	64	356		
93.8	10	11	41.5	0.943	38	242						11	22	44.7	61	351		
100.0	10	10	04.1	1.038	39	240	10	11	08.5	202	142	11	22	11.8	65	356	2 08.7	80
100.0	10	13	18.1	1.038	37	241	10	14	25.0	208	148	11	23	58.4	65	357	2 13.9	78
100.0	10	11	39.9	1.038	38	240	10	12	55.7	272	212	11	23	08.2	66	358	2 31.6	79
99.6	10	16	54.5	0.993	33	242						11	25	53.8	68	1		
100.0	10	23	56.1	1.035	25	245	10	25	03.8	230	168	11	29	05.7	67	359	2 15.4	73
99.3	10	21	24.2	0.990	28	243						11	28	01.7	68	2		
100.0	10	18	35.9	1.036	32	243	10	19	27.1	197	136	11	26	40.7	66	358	1 42.4	76
98.0	10	20	55.4	0.978	29	245						11	27	41.5	65	356		
99.8	10	23	13.8	0.995	26	245						11	28	46.4	66	358		
100.0	10	15	44.3	1.037	34	242	10	16	05.1	170	109	11	25	13.9	65	357	0 41.6	78
100.0	10	09	55.9	1.038	39	240	10	11	15.9	267	209	11	22	10.3	66	358	2 40.1	80

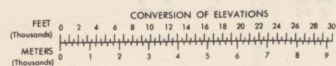
LOCAL CIRCUMSTANCES

Geographic Locations	First Contact						Second Contact			
	Latitude	Longitude	Universal Time			P	V	Universal Time		
			h	m	s			h	m	s
INDIA(Cont.)	°	'	°	'		°		h	m	s
Khamman	+17 15.0	- 80 09.0	9 01 16.1	245	197			10 17 31.9	77	16
Kodaikanal, <i>Astrophysical Observatory</i>	+10 13.8	- 77 28.1	8 51 38.8	254	203					
Kolhapur	+16 42.0	- 74 14.0	8 49 16.4	240	202					
Koraput	+18 49.0	- 82 43.0	9 06 41.1	244	195			10 21 02.7	29	328
Machilipatnam	+16 11.0	- 81 08.0	9 02 28.4	247	197					
Mahbubnagar	+16 45.0	- 77 59.5	8 56 51.2	244	199			10 14 57.5	31	331
Midanapur	+22 25.0	- 87 19.0	9 15 13.1	242	192					
Miraj	+16 49.0	- 74 41.0	8 50 18.4	241	201					
Naini Tal, <i>Uttar Pradesh State Observatory</i>	+29 21.6	- 79 27.4	9 09 48.5	225	188					
Nalgonda	+17 03.0	- 79 16.0	8 59 30.0	244	198			10 16 24.8	58	358
Nandyal	+15 29.2	- 78 29.0	8 56 56.6	246	199					
Nellora	+14 27.0	- 79 59.0	8 59 19.1	249	199					
Nizamabad	+18 40.0	- 78 06.0	8 58 29.5	241	197					
Ootaramund, <i>Radio Astr. Ctr., Tata Inst.</i>	+11 22.9	- 76 40.0	8 50 26.6	251	203					
Palkonda	+18 36.2	- 83 45.4	9 08 17.0	246	195			10 21 54.8	96	35
Panaji	+15 29.8	- 73 49.2	8 47 16.1	242	203					
Puri	+19 48.0	- 85 49.0	9 12 02.6	245	194			10 23 56.1	58	356
Raichur	+16 12.0	- 77 21.0	8 55 10.9	244	200			10 13 40.3	56	356
Raigarh	+21 53.0	- 83 23.0	9 09 25.1	240	193					
Raipur	+21 14.0	- 81 39.0	9 06 21.8	240	194					
Rajahmundry	+17 02.0	- 81 46.5	9 04 05.9	246	197					
Ranibannur	+14 37.0	- 75 37.2	8 50 22.9	245	202					
Ratnagiri	+16 59.0	- 73 20.0	8 47 40.9	239	203					
Salur	+18 31.0	- 83 12.5	9 07 20.2	245	195			10 21 14.2	81	20
Shimoga	+13 56.0	- 75 38.0	8 49 52.5	246	203					
Sholapur	+17 40.0	- 75 54.0	8 53 30.1	240	200					
Silchar	+24 49.0	- 92 48.0	9 22 28.1	242	190					
Sinoncha	+18 51.0	- 79 58.0	9 01 58.5	242	196					
Sompeta	+18 56.4	- 84 36.5	9 09 48.7	246	195			10 22 49.0	97	36
Srikakulam	+18 17.5	- 83 54.0	9 08 22.4	246	195					
Titalagarh	+20 18.0	- 83 18.0	9 08 24.5	242	194					
Tura	+25 31.0	- 90 14.0	9 19 55.1	239	190					
Vengurla	+15 52.0	- 73 38.0	8 47 13.0	241	203					
Vijayawada	+16 30.7	- 80 37.5	9 01 42.4	246	198					
Vishakhapatnam	+17 43.0	- 83 14.0	9 06 59.3	247	196					
Vizianagaram	+18 07.0	- 83 24.1	9 07 27.8	246	195					
Warangal	+17 58.0	- 79 36.0	9 00 43.6	243	197					
PEOPLE'S REPUBLIC OF CHINA										
Ch'ang-Ning	+24 50.0	- 99 36.0	9 28 49.5	247	190					
Chen-Kang	+24 06.2	- 99 23.5	9 28 38.8	248	191			10 32 10.0	87	24
Chien-Ho	+26 39.4	-108 34.8	9 34 25.1	249	190			10 33 31.0	60	357
Hsia-Kuan	+25 35.0	-100 12.5	9 29 19.0	246	190					
Kuei-Yang	+26 35.0	-106 42.0	9 33 28.6	248	190			10 34 04.4	345	282
K'un-Ming	+25 03.0	-102 43.0	9 31 11.5	248	191			10 32 59.5	83	20
Nanking, <i>Purple Mt. Observatory</i>	+32 04.0	-118 49.3	9 36 10.4	245	188					
T'ai-Chiang	+26 40.5	-108 18.4	9 34 16.6	249	190			10 33 31.7	49	346
Tu-Yun	+26 15.5	-107 30.6	9 33 57.2	249	190			10 33 31.4	81	18
Yao-An	+25 30.7	-101 14.0	9 30 06.1	247	190					

LOCAL CIRCUMSTANCES

Obscuration	Maximum Eclipse			Sun's		Third Contact			Fourth Contact			Duration		Width of					
	Universal	Magnitude		Alt.	Az.	Universal	P	V	Universal	P	V		Path						
	Time					Time			Time										
%	h	m	s	°	°	h	m	s	°	°	h	m	s	m	mi				
100.0	10	18	47.6	1.036	31	243	10	20	03.3	234	173	11	26	47.8	66	358	2	31.4	76
81.0	10	11	39.9	0.843	38	245						11	21	31.7	56	342			
95.6	10	11	06.1	0.957	38	238						11	22	48.3	69	3			
100.0	10	22	01.2	1.035	28	244	10	22	59.7	283	222	11	28	18.5	68	0	1	57.0	74
97.0	10	19	27.5	0.969	31	244						11	26	57.5	64	355			
100.0	10	16	04.0	1.037	34	242	10	17	10.5	279	219	11	25	27.9	67	359	2	13.0	77
94.7	10	26	36.5	0.952	21	246						11	29	55.6	72	6			
95.9	10	11	47.2	0.960	38	239						11	23	11.0	69	3			
57.7	10	19	36.4	0.656	26	237						11	22	17.2	88	33			
100.0	10	17	42.8	1.036	32	242	10	19	00.7	252	192	11	26	16.9	66	359	2	35.9	76
98.7	10	16	05.2	0.984	34	243						11	25	21.0	64	355			
92.5	10	17	22.3	0.933	33	244						11	25	40.7	61	351			
94.9	10	16	56.7	0.952	33	241						11	25	50.5	70	4			
86.8	10	11	22.0	0.888	39	244						11	22	00.3	58	346			
100.0	10	22	57.1	1.035	27	245	10	23	59.3	216	154	11	28	40.9	67	359	2	04.5	73
99.0	10	09	51.9	0.987	39	239						11	22	09.4	67	0			
100.0	10	25	04.1	1.034	24	246	10	26	12.2	255	194	11	29	32.6	68	1	2	16.1	71
100.0	10	15	01.0	1.037	35	241	10	16	21.6	254	194	11	24	54.7	66	358	2	41.3	78
91.1	10	23	16.4	0.922	26	243						11	28	33.5	73	8			
90.9	10	21	30.6	0.921	28	242						11	27	49.0	72	8			
98.9	10	20	28.6	0.986	30	244						11	27	31.1	65	356			
100.0	10	11	55.1	0.999	38	241						11	23	11.8	64	356			
92.9	10	09	57.2	0.936	39	237						11	22	06.0	70	5			
100.0	10	22	24.2	1.035	27	245	10	23	34.3	231	169	11	28	27.3	67	359	2	20.1	74
98.1	10	11	32.4	0.978	38	241						11	22	53.6	63	354			
94.9	10	13	48.6	0.952	36	239						11	24	14.4	70	4			
92.7	10	30	06.8	0.936	15	248						11	30	35.6	73	9			
97.2	10	19	08.6	0.971	31	242						11	26	57.4	69	3			
100.0	10	23	49.4	1.035	26	245	10	24	49.9	215	153	11	29	02.6	67	359	2	00.9	73
99.9	10	22	59.9	0.997	27	245						11	28	40.7	66	358			
96.9	10	22	55.5	0.969	26	244						11	28	38.3	70	4			
86.7	10	28	34.9	0.889	17	246						11	29	54.4	76	13			
97.5	10	09	48.0	0.973	39	238						11	22	06.7	68	2			
98.9	10	19	02.0	0.986	31	244						11	26	49.7	65	356			
99.1	10	22	11.3	0.988	28	245						11	28	18.1	65	357			
99.9	10	22	28.4	0.998	27	245						11	28	27.3	66	358			
99.5	10	18	26.4	0.993	31	242						11	26	38.9	68	1			
99.9	10	33	00.1	0.998	9	252						..	..	..	..	..			
100.0	10	33	00.5	1.030	9	252	10	33	51.1	230	168	..	..	..	..	..	1	41.1	63
100.0	10	34	15.4	1.027	0	256	10	34	59.9	260	197	..	..	..	..	..	1	28.9	58
98.1	10	33	05.2	0.980	8	252						..	..	..	..	..			
100.0	10	34	08.2	1.027	2	255	10	34	12.0	335	273	..	..	..	..	..	0	07.6	59
100.0	10	33	48.2	1.029	6	253	10	34	36.8	236	173	..	..	..	..	..	1	37.3	60
88.3	..	..	..	..	..	..						..	..	..	..	..			
100.0	10	34	14.0	1.027	0	256	10	34	56.3	271	208	..	..	..	..	..	1	24.6	58
100.0	10	34	16.6	1.027	1	255	10	35	01.7	239	176	..	..	..	..	..	1	30.3	57
99.3	10	33	23.2	0.991	7	253						..	..	..	..	..			

ELEVATIONS IN FEET



MAXIMUM TERRAIN ELEVATIONS

Maximum Terrain elevation figures centered in the area bounded by ticked lines of LATITUDE and LONGITUDE, are represented in THOUSANDS and HUNDREDS of feet, BUT DO NOT INCLUDE ELEVATIONS OF VERTICAL OBSTRUCTIONS.

3100 feet.....31

ATTENTION THIS CHART CONTAINS MAXIMUM ELEVATION FIGURES (MEF)

The Maximum Elevation Figures shown in quadrangles bounded by ticked lines of latitude and longitude are represented in THOUSANDS and HUNDREDS of feet above mean sea level. The MEF is based on information available concerning the highest known feature in each quadrangle, including terrain and obstructions (trees, towers, antennas, etc.). In areas of extensive unreliable relief, the MEF is shown by a note spread across the area.

Example: 12,500 feet.....12⁵

CULTURE

Actual city outline Towns and Villages
Outline unknown
Landmark features (unillustrated) Dual lane roads
Primary roads Secondary roads
Tracks and trails Multiple track R.R.
Single track R.R. Power transmission line.....

PICTORIAL SYMBOLIZATION

A black square indicates location

AERONAUTICAL INFORMATION

Major aerodromes
Runway pattern and 6000 foot diameter circle is shown at 1:500,000 scale. Center of circle represents true position of airfield.
Major aerodromes, runway pattern not available
Minor aerodromes.....

Major aerodromes portrayed have a hard surface runway length of 3000 feet or more. When runway pattern is not shown, number following the name indicates length of longest runway to nearest hundreds of feet. Aerodrome elevations are in feet above sea level.

OBSTRUCTIONS

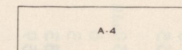
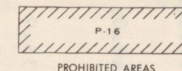
Vertical obstructions.....
Highest vertical obstruction (above MSL) within ticked lines of latitude and longitude.....
Multiple obstructions.....
Vertical obstructions with landmark significance.....

Numbers adjacent to obstruction indicate elevation of top of obstruction above mean sea level (MSL). Numerals in parentheses indicate height above ground level (AGL). Vertical obstructions under 200 feet in height (AGL) are not shown.

RADIO AIDS TO NAVIGATION

VHF OMNI RANGE (VOR)
VORTAC
TACAN
VOR with DME
Other Facilities

SPECIAL USE AIRSPACE



NUMBERS INDICATE INTERNATIONALLY
RECOGNIZED NUMERICAL
IDENTIFICATION

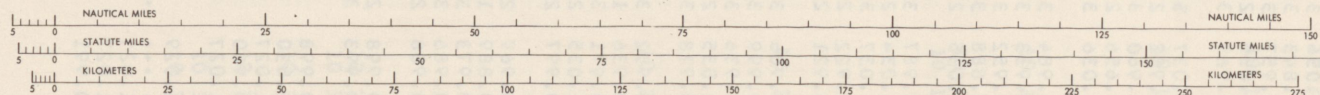
All Special Use Airspace is portrayed in the body of this chart with the following exception:
(1) Those that are activated only by NOTAM
(2) Danger areas

NOTES

This chart is not an authority for international boundaries. Division of Insular Sovereignty (land areas only).....
Geographic names or their spellings do not necessarily reflect recognition of the political status of an area by the United States Government.

Numerous dwellings that do not cluster into villages are prevalent along the coastline and major rivers of India.

CAUTION: The alignment of power transmission lines is approximate.

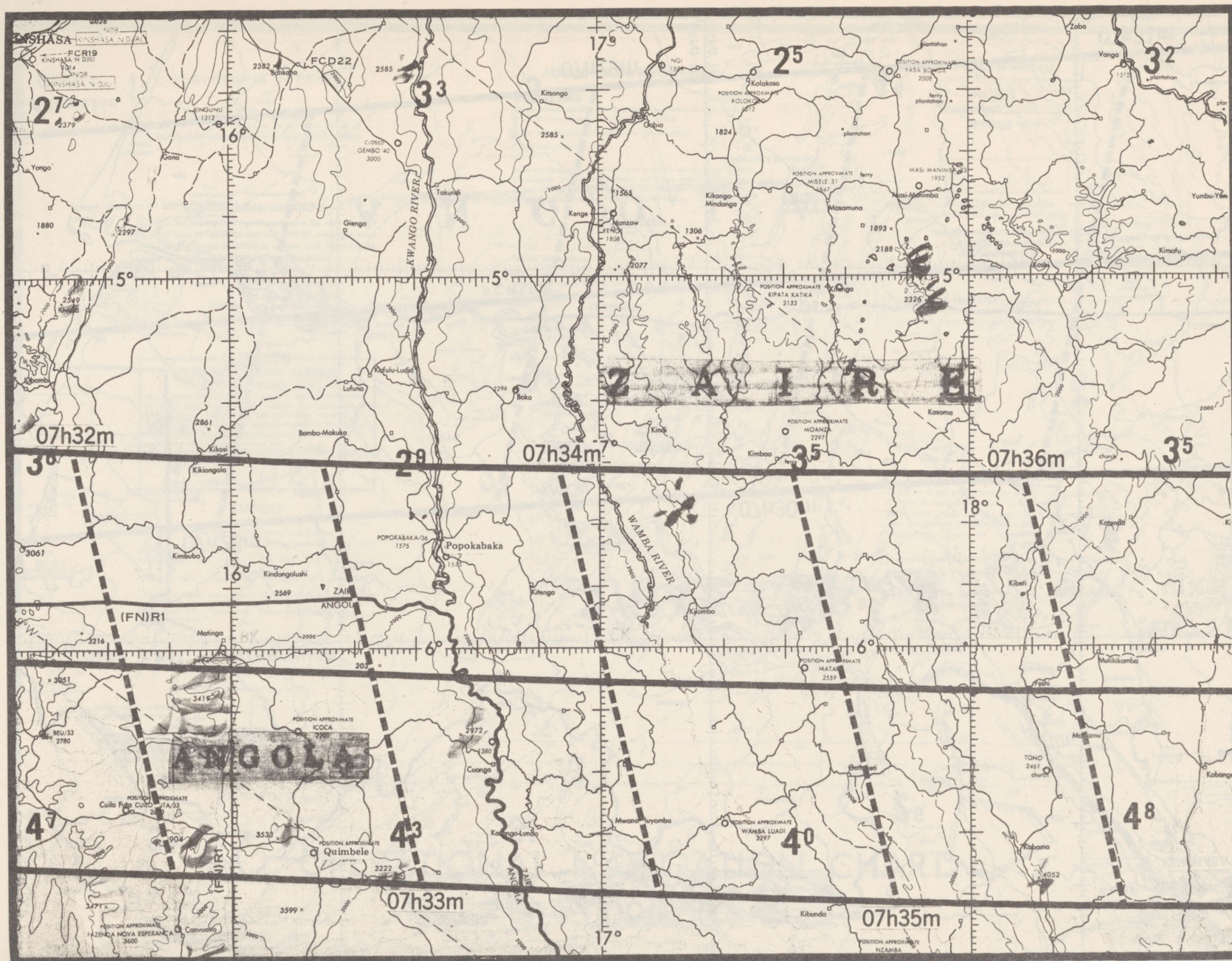


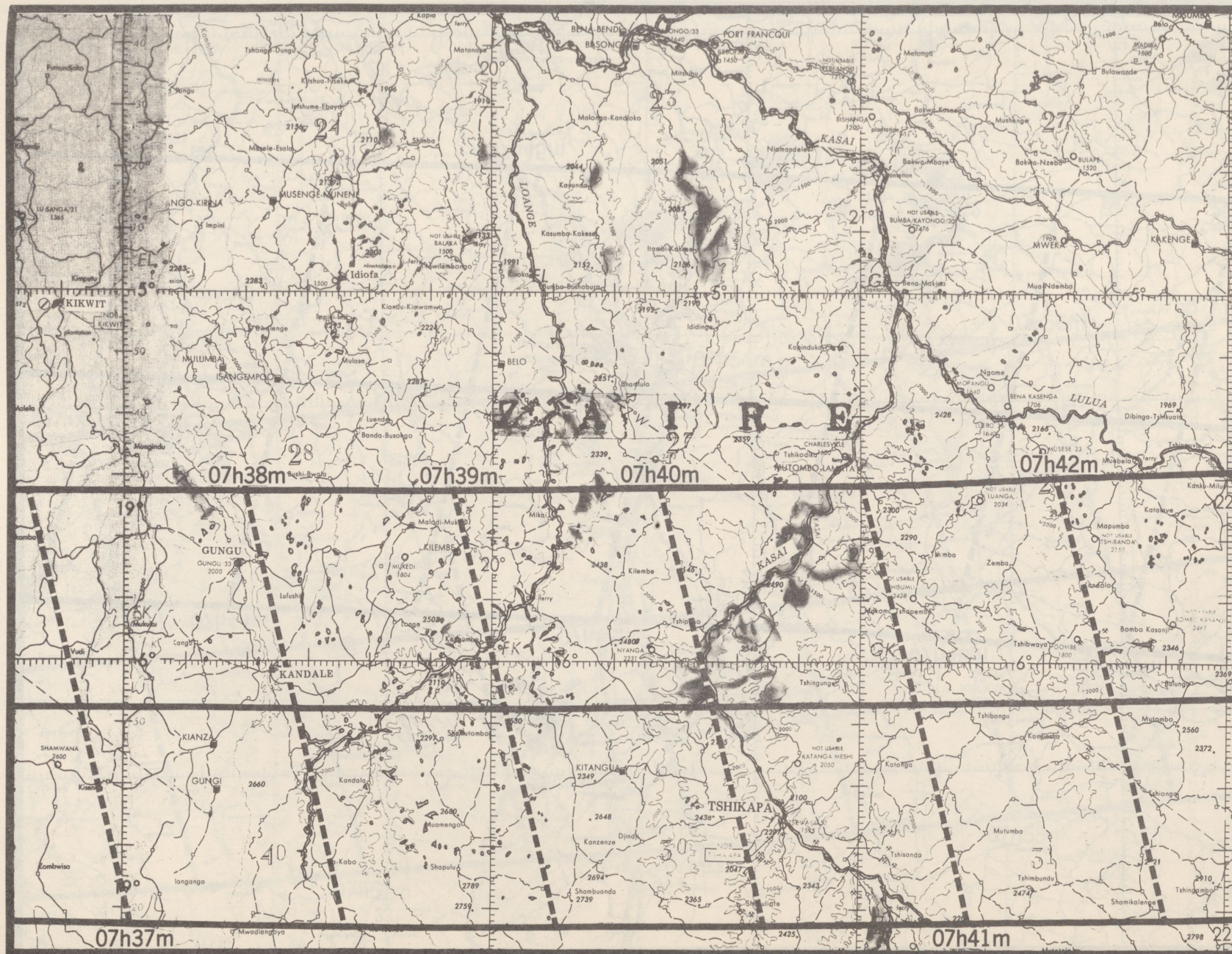
OPERATIONAL NAVIGATION CHART

1:1,000,000

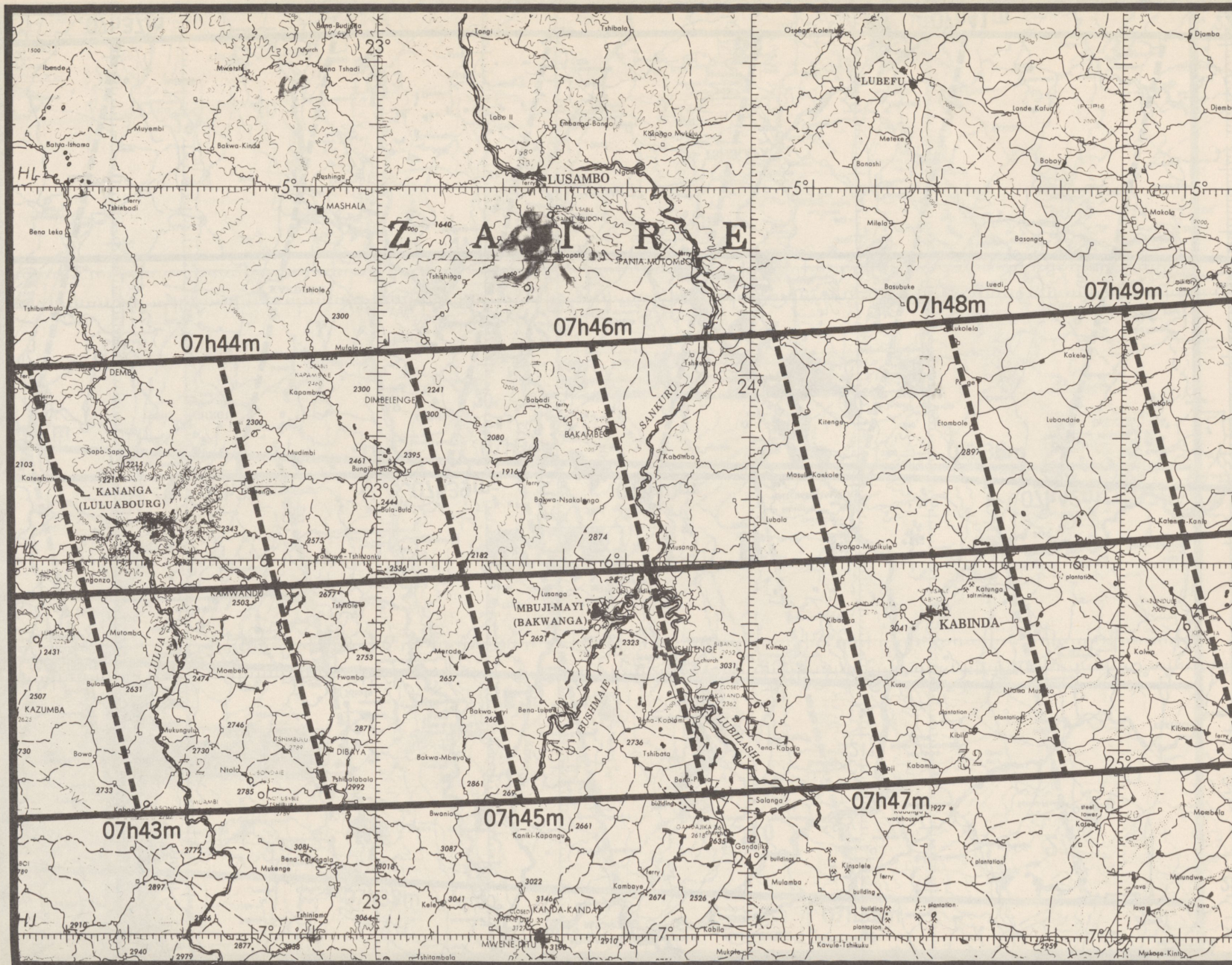


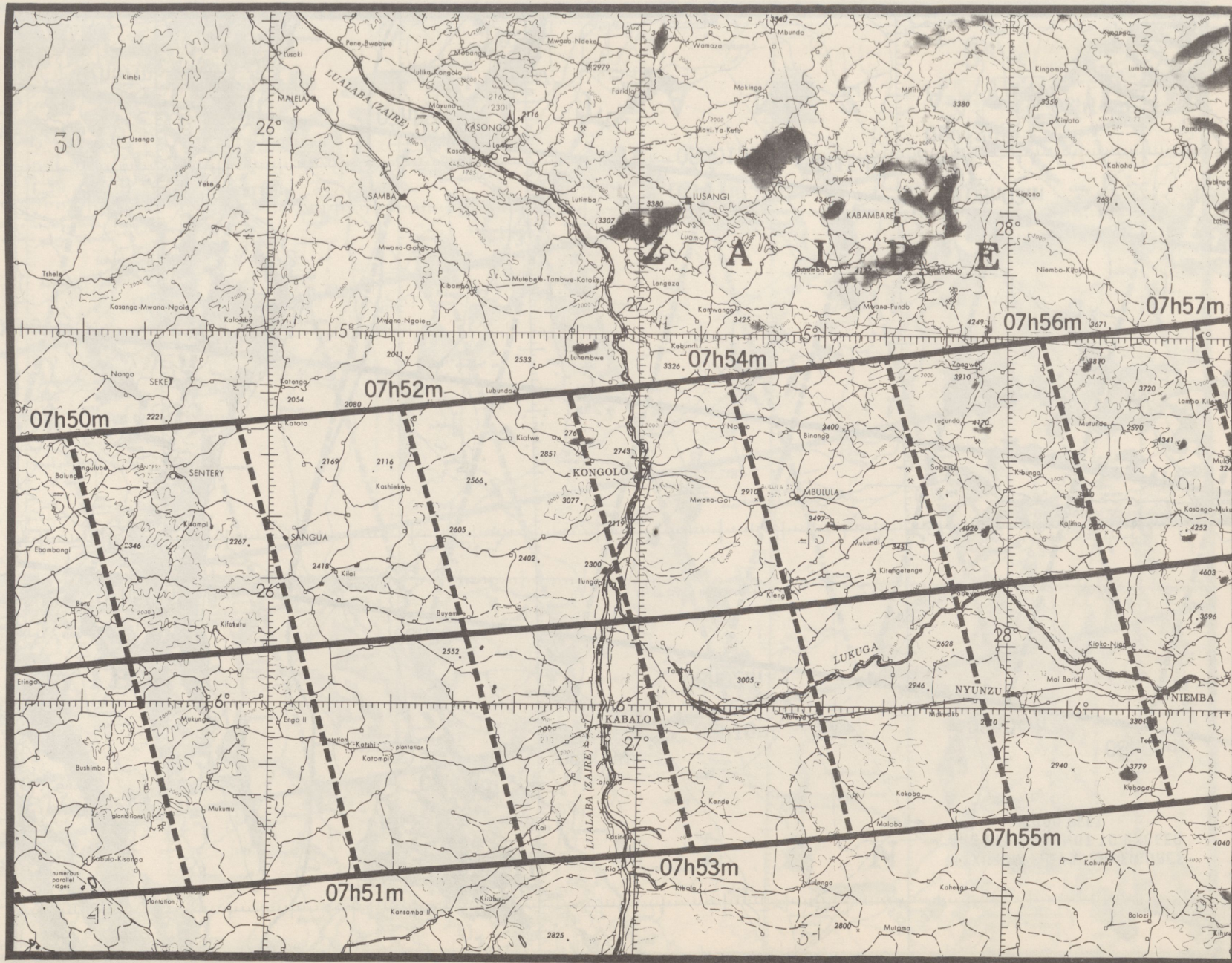
TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980



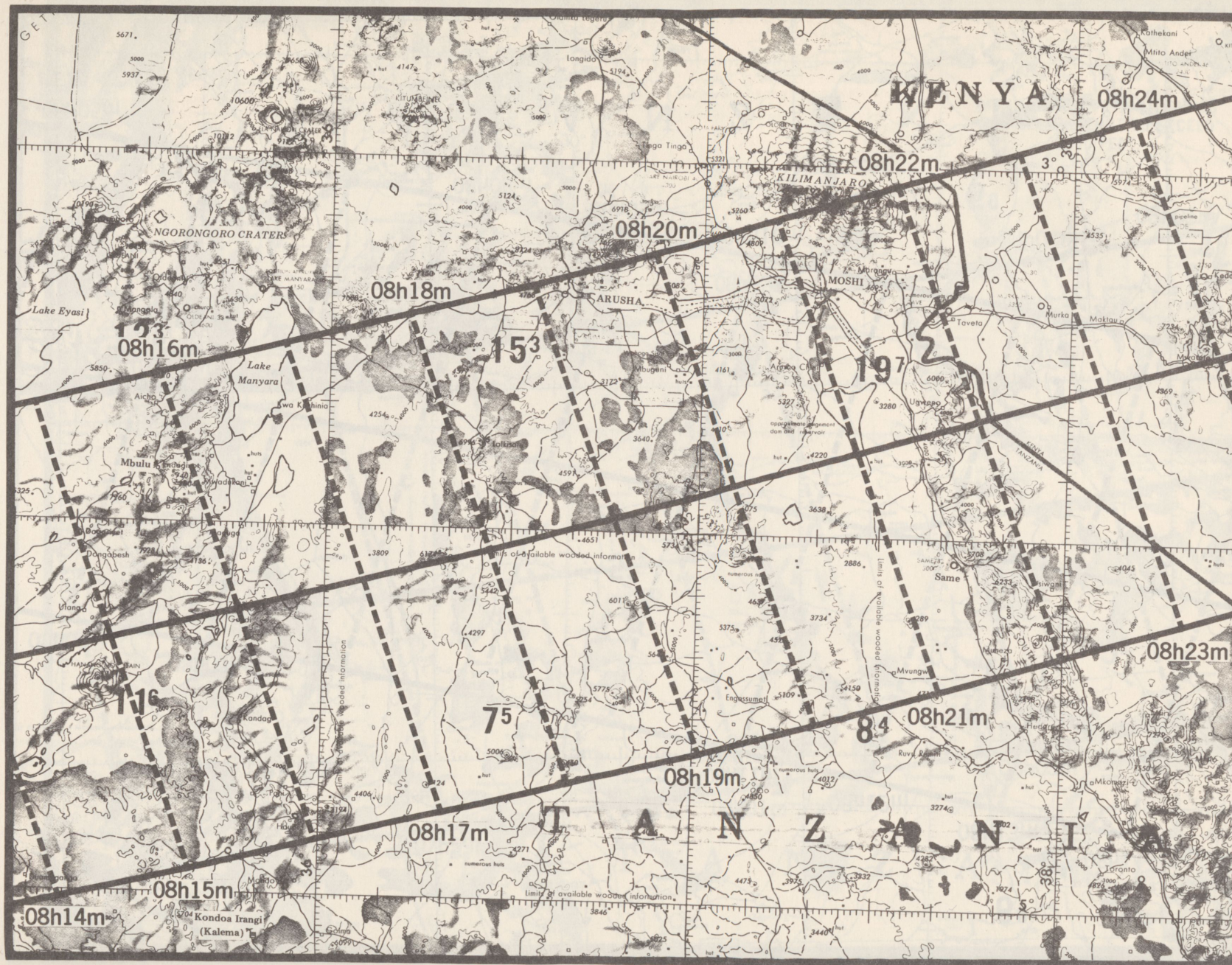


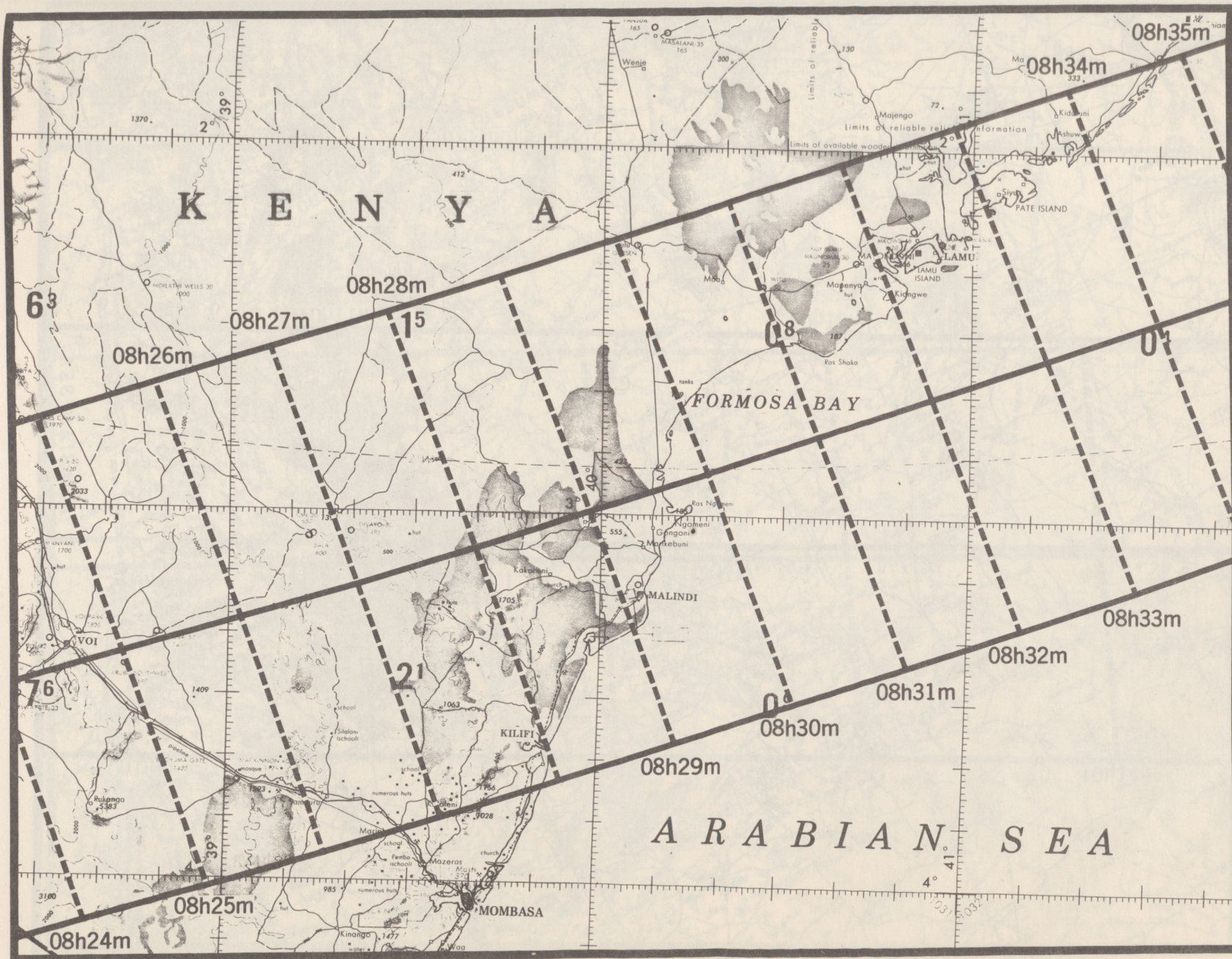
TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980



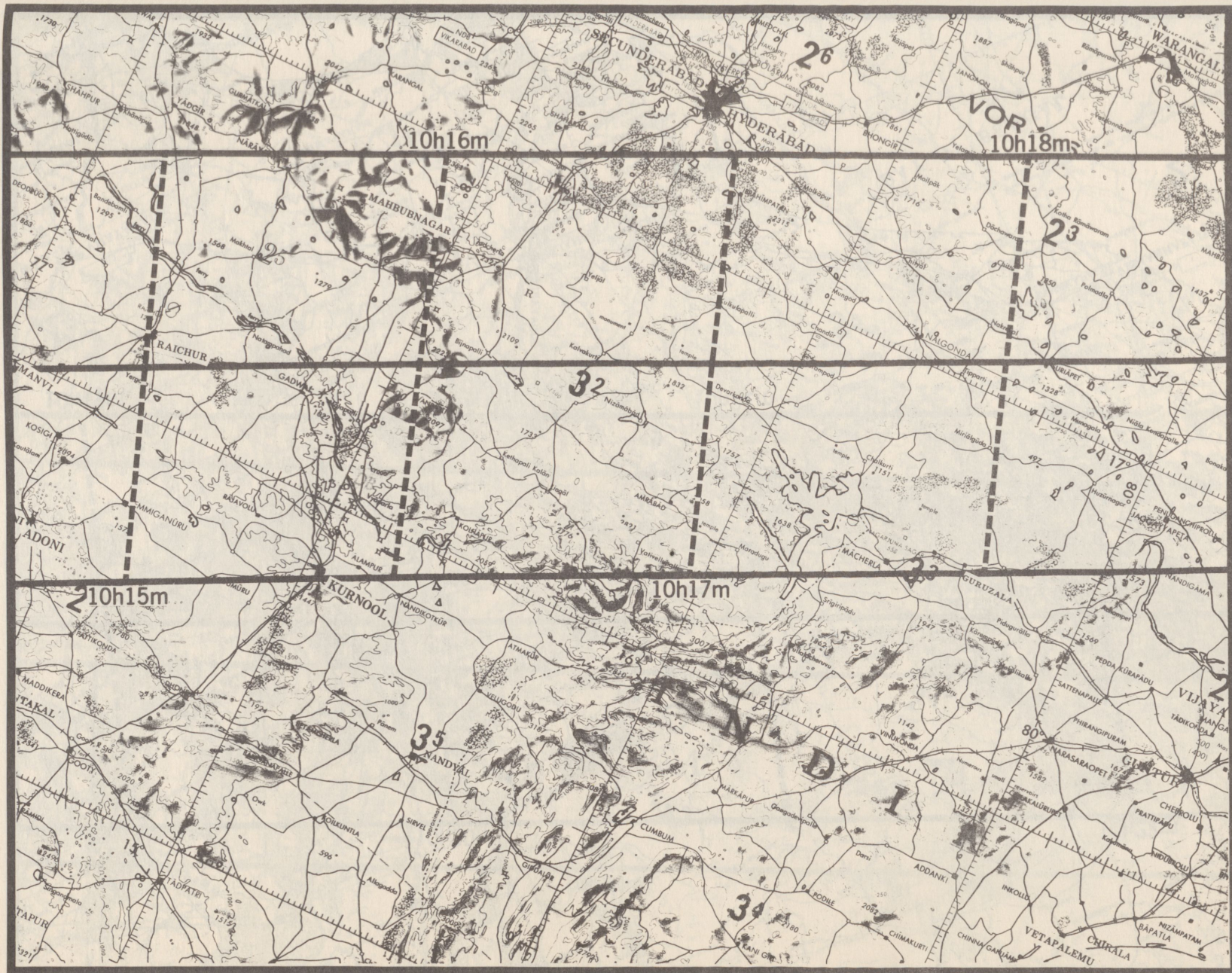


TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980

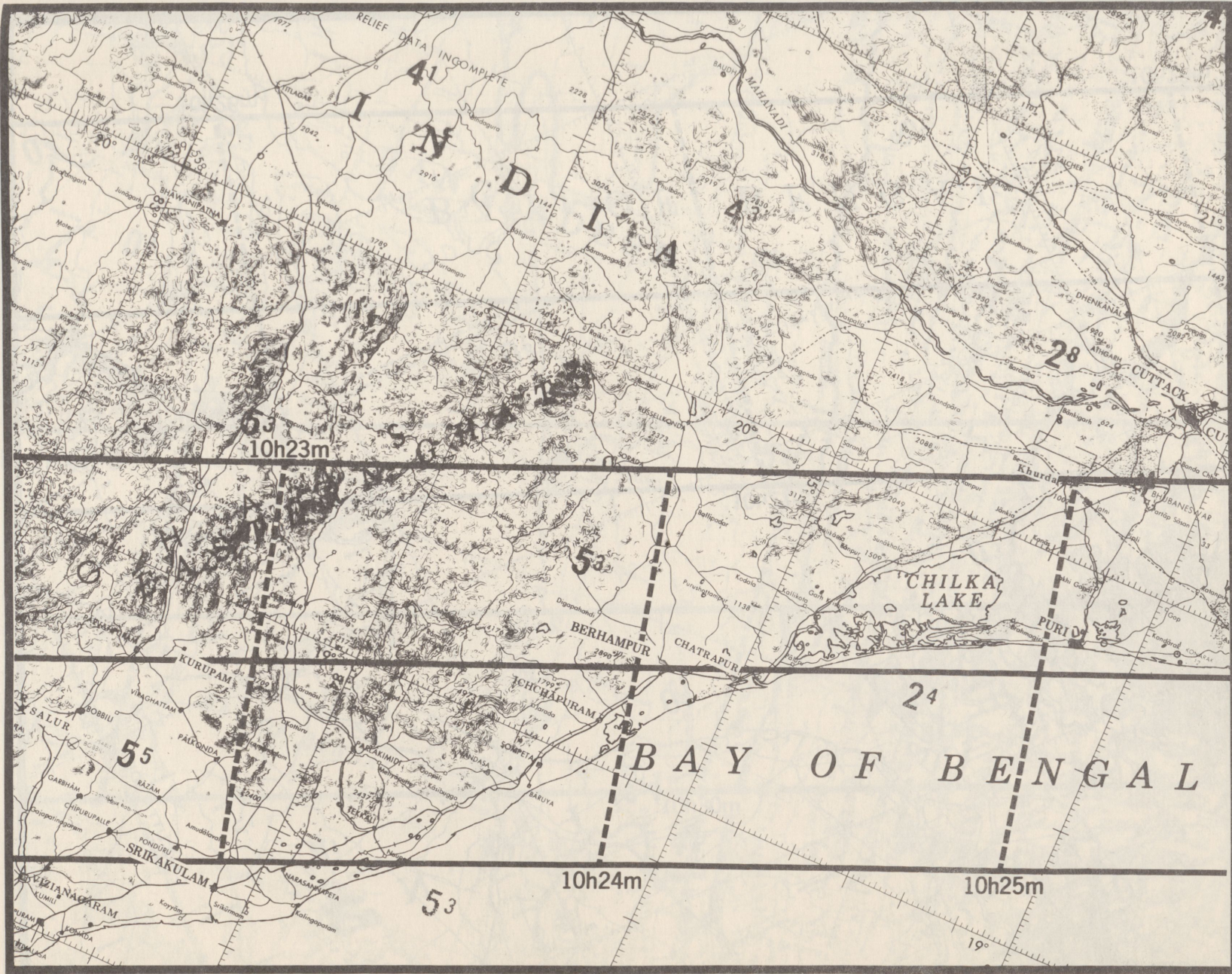




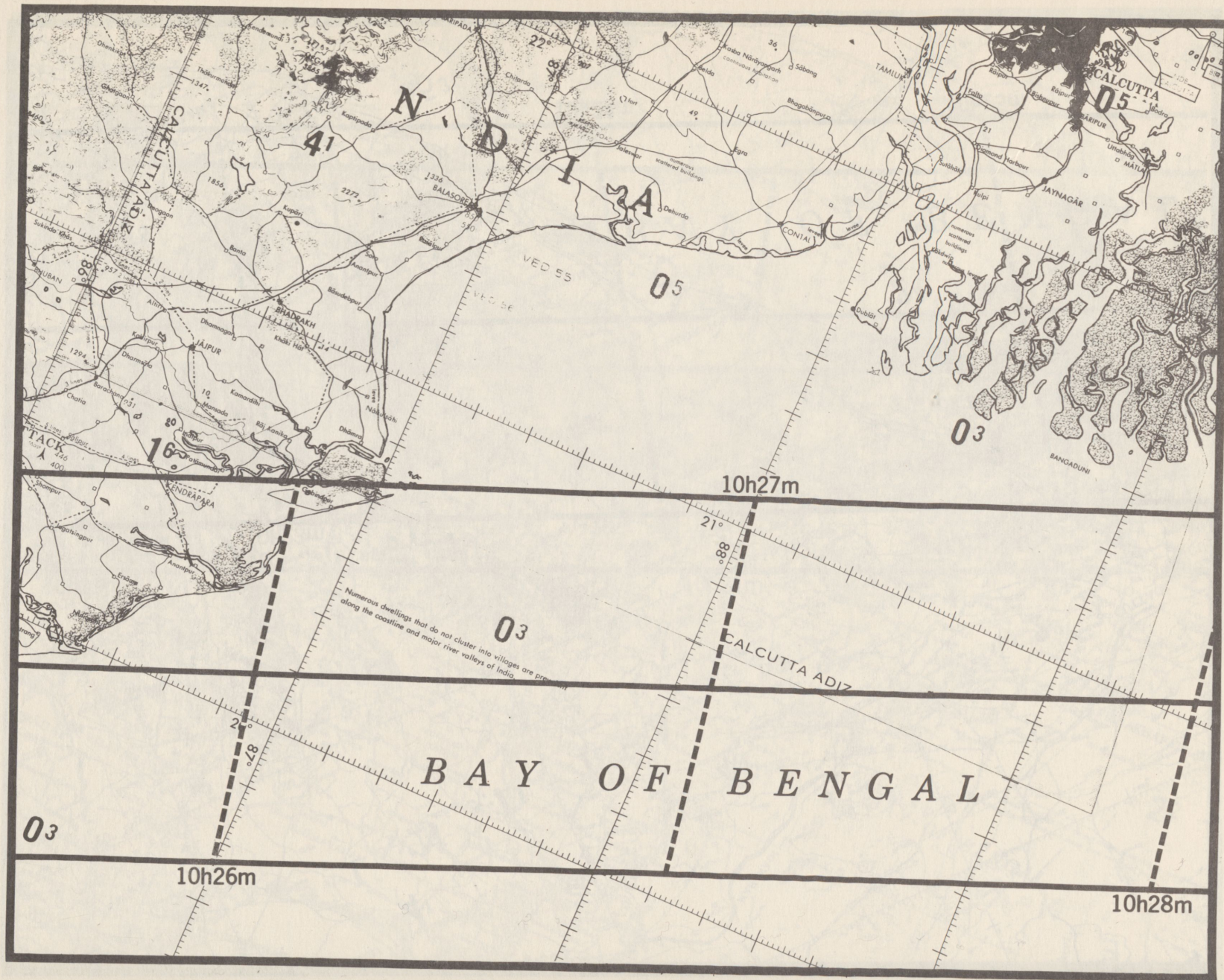
TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980



TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980



TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980



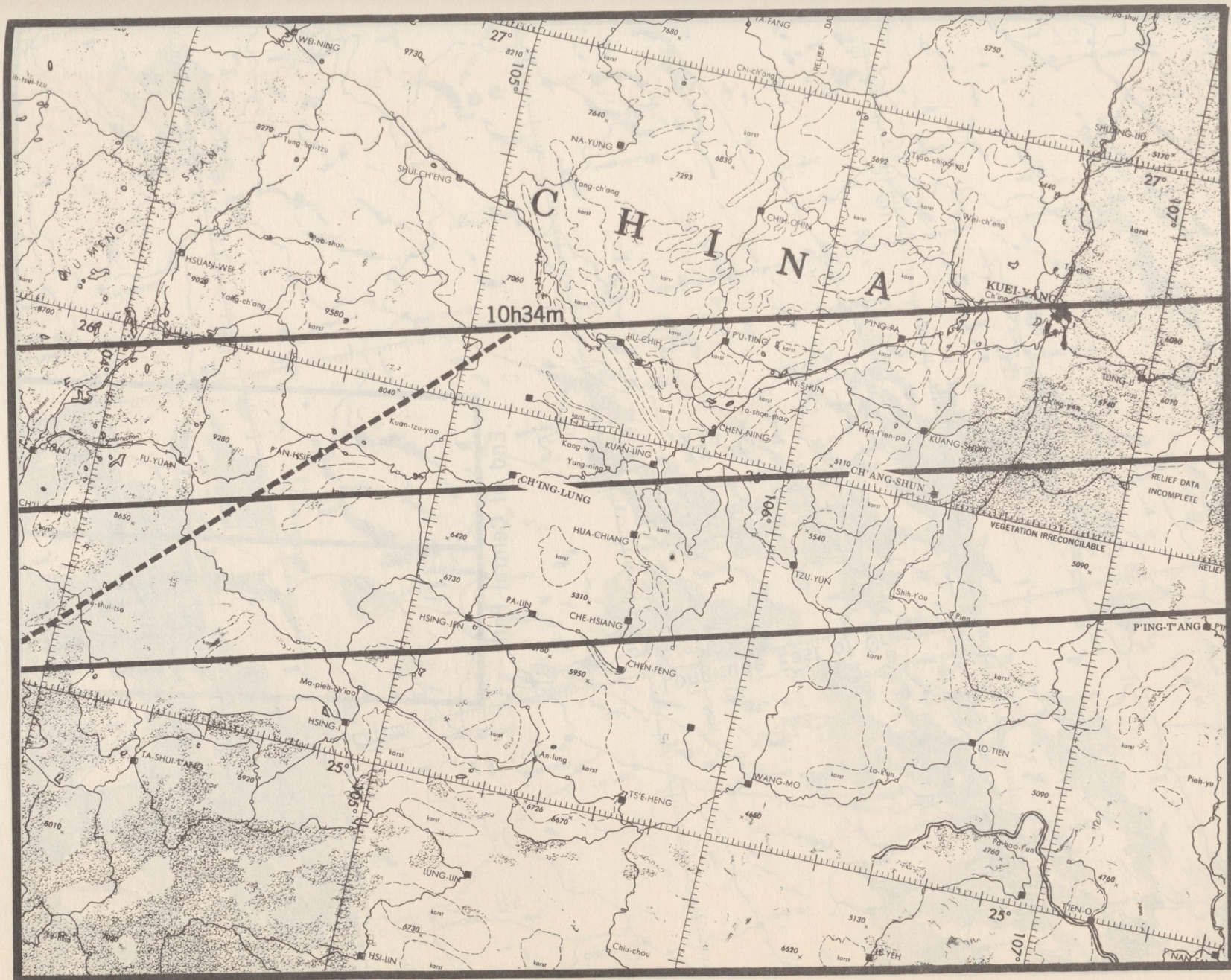


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